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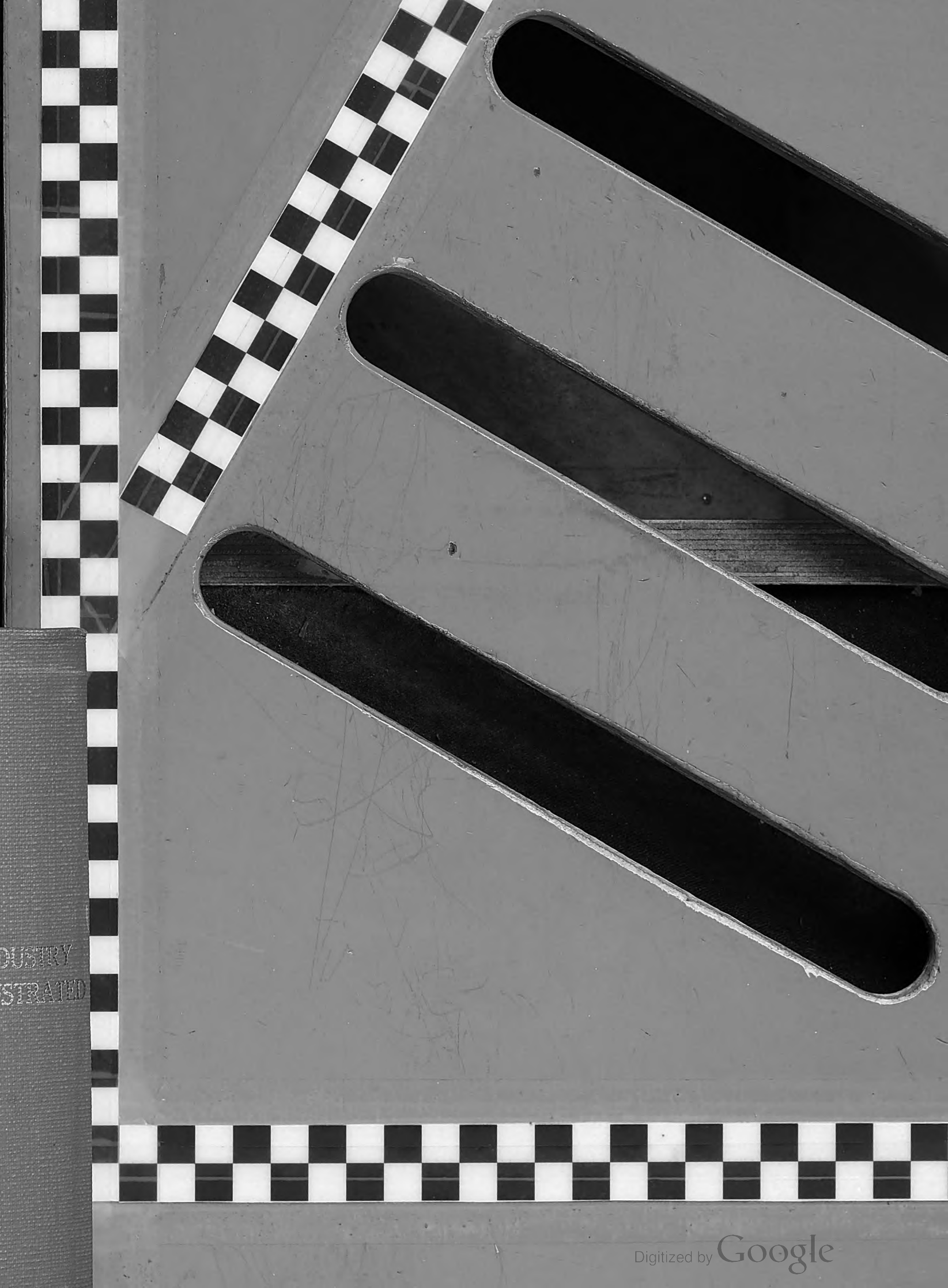
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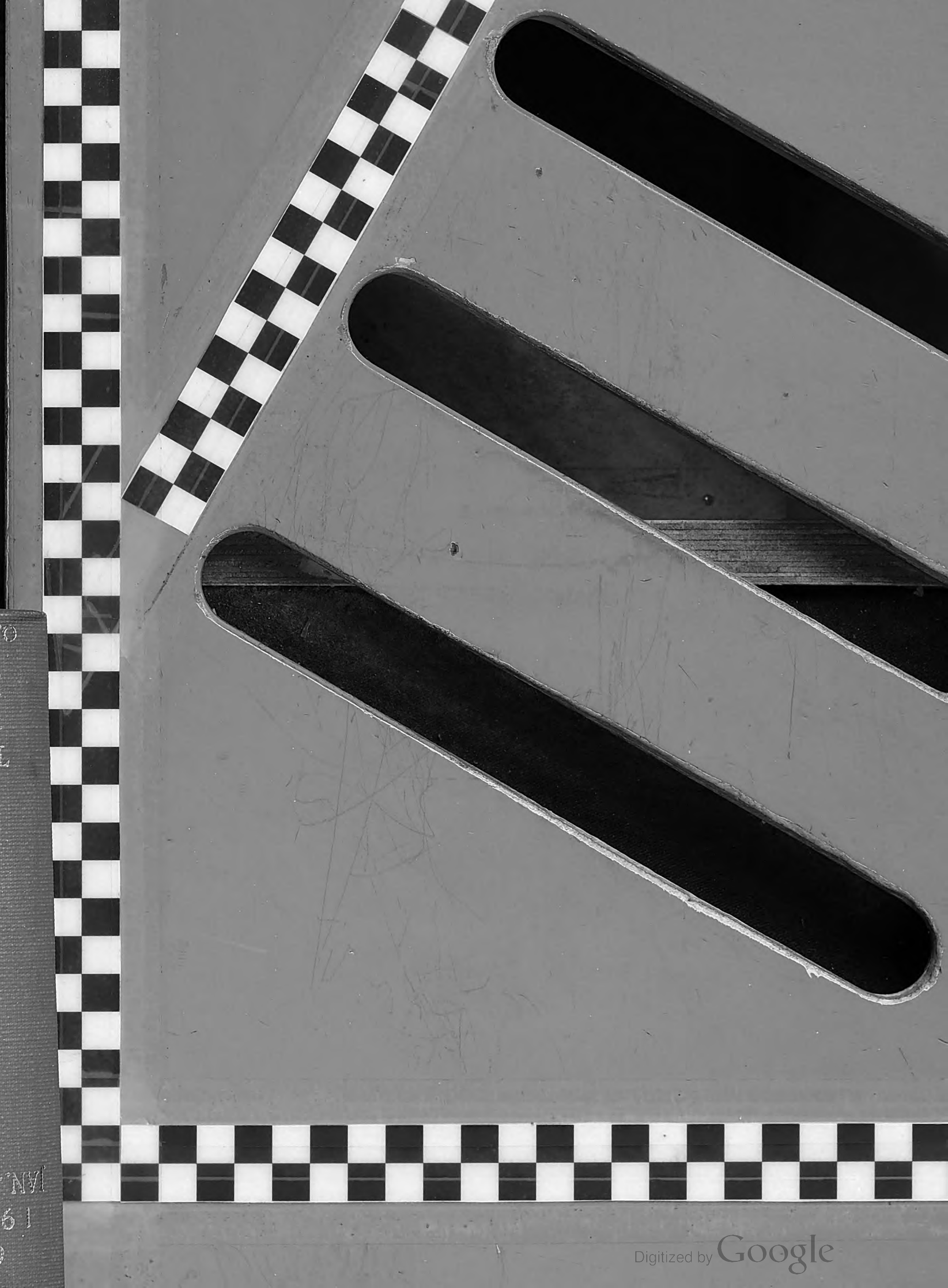
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Industry Illustrated

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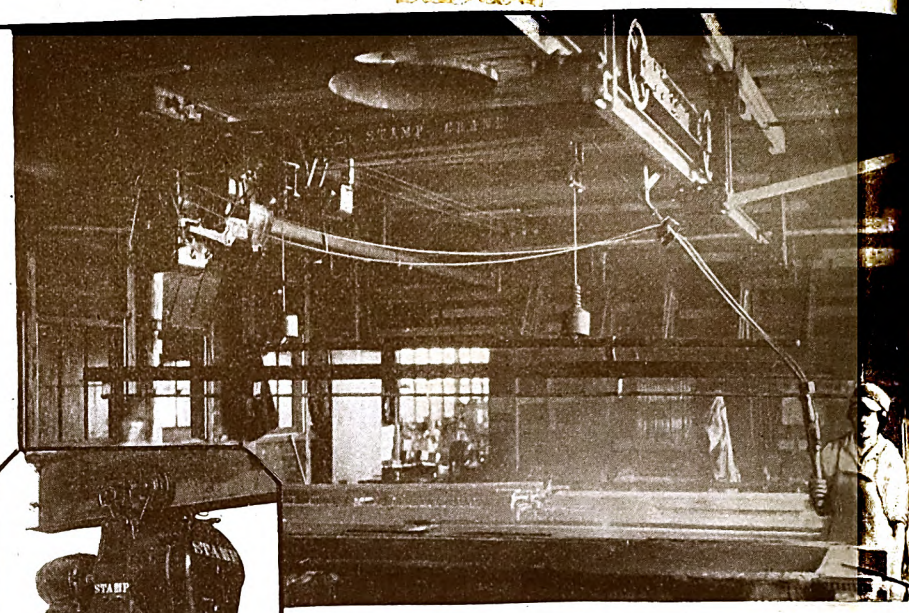
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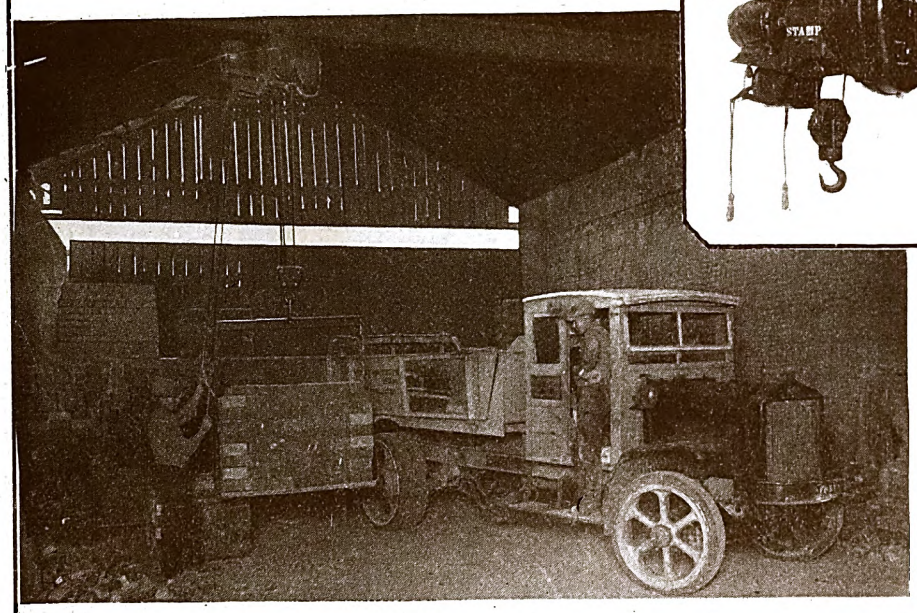
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In Dust—Grit—and Acid Fumes





This Hyatt equipped Stamp hoist, used by a chemical plant, to and from a dipping vat, is constantly enveloped in acid fumes.

A one-ton Stamp hoist manufactured by the Stamp Electric Hoist Company, Cleveland, Ohio, embodying seven Hyatt bearings.

A Stamp hoist, equipped with Hyatt roller bearings, handling loads of brick from kiln to truck. Continually covered with brick dust and grit.

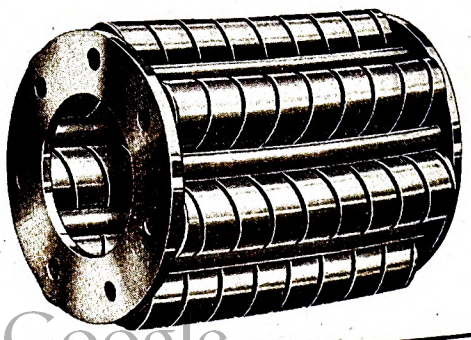
The efficient operation of Hyatt equipped cranes, trolleys and hoists is not hampered by the unfavorable conditions under which they work. These machines are fortified against any damage from the dirt and grit that settles on them.

The sturdy construction of Hyatt bearings enables them to withstand overloading and severe emergency duty. Even abuse and neglect at the hands of unskilled labor fail to cause any trouble. These bearings give smooth, uninterrupted service, year in and year out, without adjustment or replacement.

Even in the presence of acid fumes the efficient operation of Hyatt equipped handling machinery is not retarded. The distinctive features of the bearing housing and of the roller bearing itself insure complete and continuous lubrication. And it is only necessary to oil once every three or four months.

Hyatt equipped machines save operating power and labor, and speed up the work. The crane shown above as used in a chemical plant is operated through the entire working day by one girl, eliminating additional labor formerly required for the same work. The ease with which these machines may be moved and controlled makes them well adapted to use by girls.

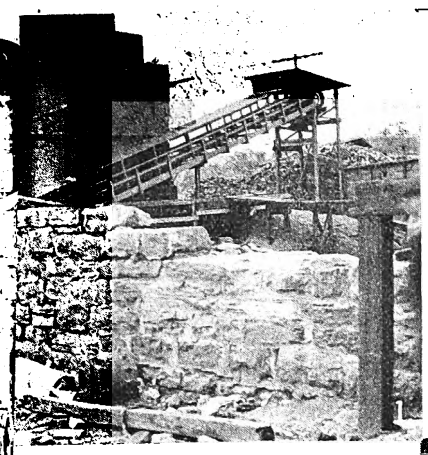
Whatever the conditions under which your trolley, crane and hoist must operate, you will find that a Hyatt equipped installation will handle larger tonnage at lower costs.



Hyatt Roller Bearing Company

Newark Detroit Chicago San Francisco
Worcester Milwaukee Huntington Minneapolis Philadelphia
Cleveland Pittsburgh Buffalo Indianapolis

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No. 1—Where 8 men used to take a day and a half to unload a car at a plant at Newton, Pa., 2 men and a Barber-Greene now do it in 2 hours.



No. 2—Barber-Greene used for storing coal and slag in the plant of the Union Switch and Signal Company at Swissvale, Pa.

No. 3—Showing the conditions under which the Barber-Greene shown in No. 2 handles slag.



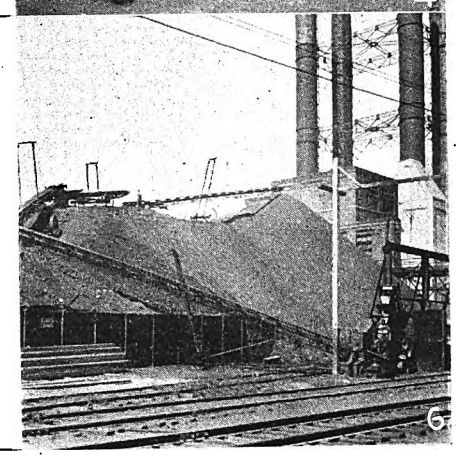
No. 4—A Barber-Greene unloading castings at Cleveland Tractor Company's plant.



No. 5—The same Barber-Greene shown in No. 4 handling coal.



No. 6—A battery of Barber-Greenes handling coal to storage in a large Massachusetts power plant.



Cutting down the P. O. U. price of materials

The vigorous current attack on the price of coal and other bulk materials in many industries is emphasizing more and more the importance of the P. O. U. price.

The old F. O. B. way of figuring leaves out of consideration what you can do in your own plant to bring down the price of the materials you use.

The P. O. U. price—the price at point of use—takes handling cost into consideration and figures the cost of coal at the boiler door instead of at the mine or on the switch track.

The P. O. U. price is the real price, and in many cases can be reduced much more easily than the F. O. B. price.

The Barber-Greene development of standard portable material handling equipment is due entirely to the attention all industries are paying to the P. O. U. price.

In many cases it has reduced the price of coal at the boiler from 10 to 50 cents per ton.

In a large number of plants the same Barber-Greenes that save 90 man hours in unloading a car of coal, stone, sand, or the like are also used for loading, unloading and transferring other materials.

If the coal situation is interesting you particularly right now because of the possibility of mining troubles in spring or before, send for our coal handling catalog.

If you are interested in materials other than coal as well, write for literature describing the use of Barber-Greenes in handling the materials in which you are interested. Barber-Greenes are sold at prices as low as $350—the base price of the U-Type Barber-Greene.

Barber-Greene Company, 500 W. Park Ave., Aurora, Illinois

Representatives in thirty-three cities

BARBER GREENE

Portable Belt Conveyors

Self Feeding Bucket Loaders

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THIS INVESTMENT PAYS

169.6%

—Yearly—

Warfield-Pratt-Howell Company
Sioux City, Iowa

10-17-19. Investment in Conveying Equipment	$2,597.63
Earnings 3 Years to 11-28-22	$13,627.42
Less Depreciation 10% per Year	408.82
Net Earnings—3 Years.....	$13,218.60
Net Earnings per Year (169.6%).....	$ 4,406.20

This is neither the highest nor the lowest record of earning power demonstrated by Standard Conveyors. It is in fact an ordinary every-day test.

In your business there is a place to invest in conveying equipment. That investment when made will start earning dividends, day in and day out, year in and year out.

Standard Conveyors are proving their worth in industries including many nationally known concerns.

We will be pleased to have you write. Our purpose is to advise conscientiously without obligating you. Then to serve you in a practical and economical way, or if we cannot to tell you who can.

Booklet S1 will show you among others the types of equipment used by the above company in earning 169.6% per year.

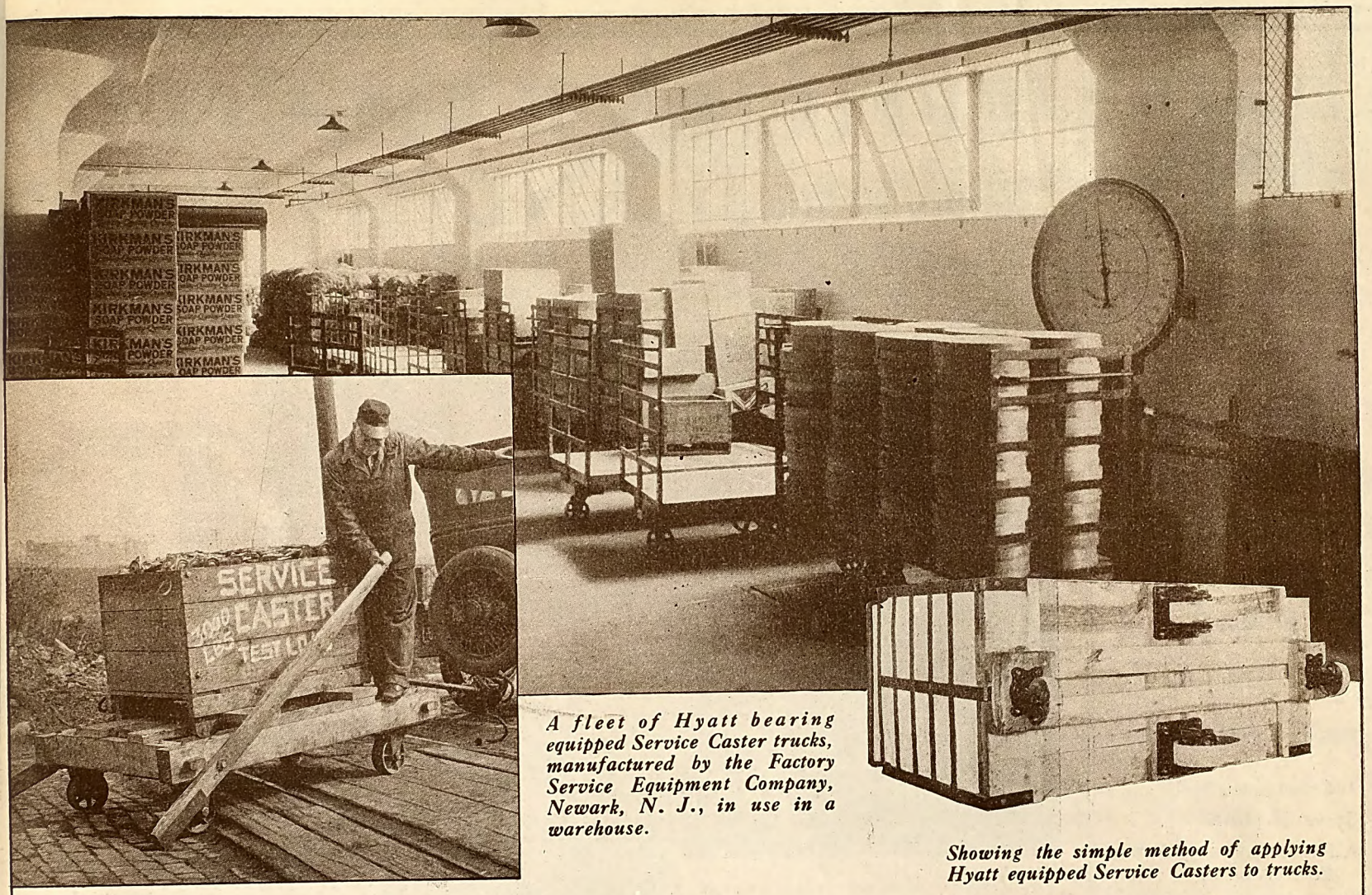
STANDARD CONVEYOR COMPANY

General Offices
NORTH ST. PAUL, MINN.

"Brown-Portable" Products Plant
NORTH CHICAGO, ILL.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

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A fleet of Hyatt bearing equipped Service Caster trucks, manufactured by the Factory Service Equipment Company, Newark, N. J., in use in a warehouse.

Showing the simple method of applying Hyatt equipped Service Casters to trucks.

Test of a Hyatt equipped Service Caster truck under 3,000 lb. load over poor city streets. Rough treatment caused no breaks or noticeable wear.

Modern Warehouses and Factories Should Use Modern Trucks

The severe requirements placed on trucks by present day handling methods are fully met by service Casters equipped with Hyatt roller bearings.

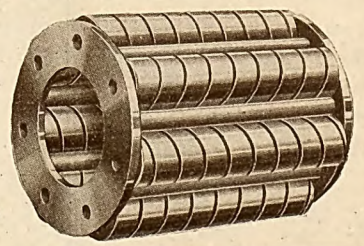
The sturdy construction of Hyatt bearings enables these already strong casters to stand up under overloading and the shocks of bumping on and off elevators, and over door sills and uneven loading platforms.

Oiling is necessary only three or four times a year. These hollow, oil retaining bearings save oil and lubricating labor.

Labor and power saving is accomplished by the easy rolling motion of the Hyatt bearings. In the warehouse shown above one man pushes the truck and makes up the job lot orders.

By specifying that your trucks, trailers and other handling machinery be equipped with Hyatt roller bearings you can speed up the work and reduce labor and maintenance costs.

Complete information will be furnished on request.



Hyatt Roller Bearing Company

Newark Detroit Chicago San Francisco
Worcester Milwaukee Huntington Minneapolis Philadelphia
Cleveland Pittsburgh Buffalo Indianapolis

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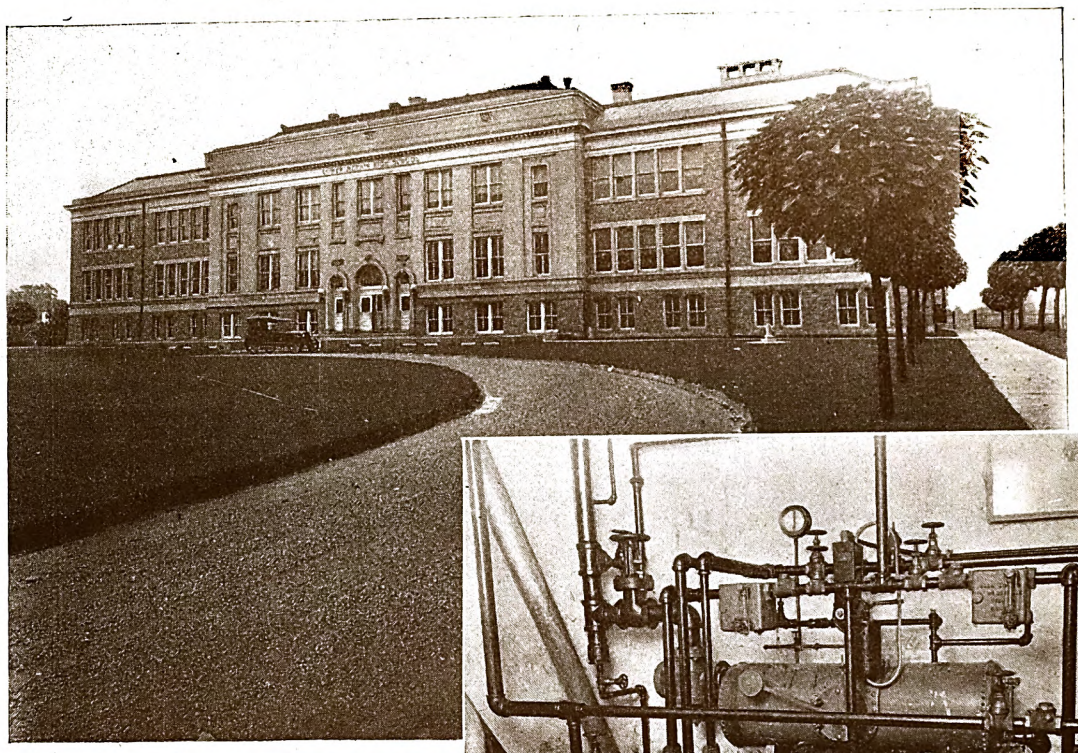
Typical JENNINGS Installations

A Series

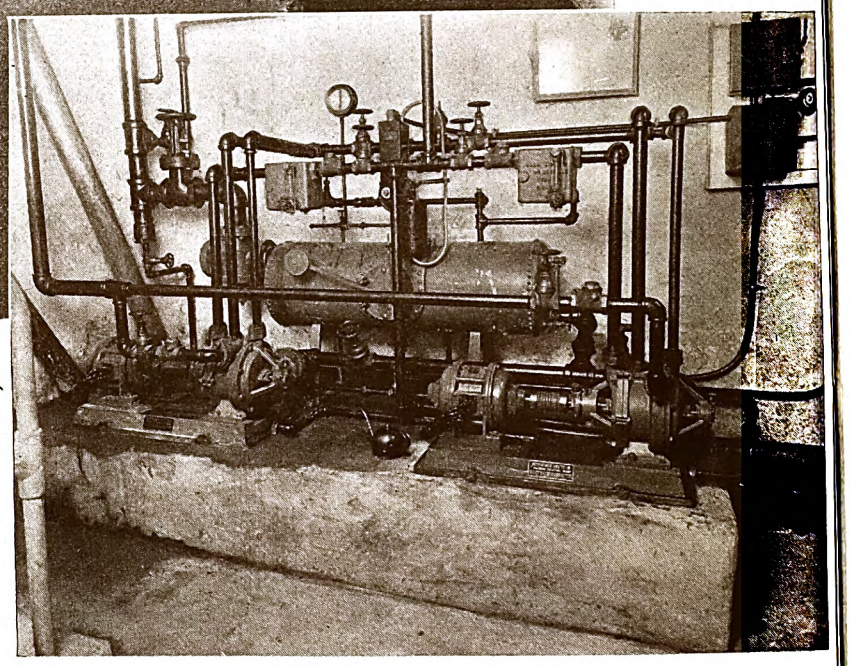
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Independence Hall
Sylvania Hotel
Atlantic Refining Company Building
Pennsylvania Warehousing & Safe Deposit Company
Lit Brothers Department Store
Bell Telephone Company of Pennsylvania
Baltimore & Ohio Railroad Company
Philadelphia Institute for Insane
Stanley Company of America
City Center Building
Corn Exchange National Bank
Ford Motor Company
Public Ledger Building
David Lupton Sons Company
Fayette R. Plumb, Inc.
Packard Motor Car Company
Philadelphia Electric Company
St. Peter & St. Paul Cathedral
Schlorer Delicatessen Company
Temple University
Westinghouse Electric & Manufacturing Company Building
Green Hill Farms Apartment Hotel

EFFICIENT HEATING *demands the* JENNINGS PUMP



Lower Merion High School
Philadelphia, Pennsylvania



Duplex "D" Unit
Automatic Operation

Capacity each pump 40,000 sq. feet direct radiation, air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute. The motors are only 3 horse power.

No matter how well designed a Return Line Heating system may be, its satisfactory operation is largely dependent upon the proper functioning of the Vacuum Return Line Pump. The Jennings pump has proven on thousands of installations that it possesses the features necessary for proper operation under the most extreme conditions.

Jennings Return Line pumps are simple in construction, containing but one moving element, running with a clearance in the casing. They are simple to install and operate, they require little floor space and are noiseless in operation. Their use results in a marked economy in coal. Many users hold that they more than pay for themselves in this respect alone. A Jennings pump on your system means quick heat in the most isolated radiators at a minimum steam pressure.

Now is the time to consider equipment for replacements and new installations for this season. Our Engineering Department is at all times ready to render service on problems relating to heating.

NASH ENGINEERING CO.

South Norwalk, **Conn., U. S. A.**

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Industry Illustrated

John H. Van Deventer, Editor

W. Thomson Lees,
Associate Editor

Adolf Schildkraut
Art Director

EDITORIAL

Which Road?

IT is not very long since we had in this country an orgy of "Trust-busting." Certain corporations had, by consolidation, built up such power in their own fields as virtually to monopolize these fields. Some among them had abused that power shamefully. This abuse brought about a popular reaction based upon false logic: that, since these oppressive monopolies were big, therefore big combinations of industrial organizations were inevitably bad. Instead of untying the knot, and preserving the useful cord, we hacked it with an axe. Instead of attempting to preserve the benefits due to coördination, at the same time exercising such supervision as would prevent abuses, we passed laws to make such combinations illegal.

Through observation of the trend *toward* monopolies in other countries, and through experience with our own efforts to *prevent* monopolies, it may be that we have learned to discriminate between the just and the unjust, the harmful and the beneficent "Trust." Yet we do not seem to have solved the problem, and it is still a common thing for the professional politician to build up a following merely by attacking "The Corporations."

The unparalleled growth of radio broadcasting during the past two years, for example, has created an immense market for the vacuum tubes used in radio reception. The patents under which these tubes are manufactured are controlled by The Radio Corporation of America, a combination which embraces, among others, such well-known organizations as the Westinghouse Electric Manufacturing Company, the Western Electric Company (a subsidiary of the American Telephone and Telegraph Company) and the General Electric Company.

There is no doubt that, in the understanding of the "muck-rakers" of a decade or two ago, the Radio Corporation constitutes a "Trust." There is no doubt that this corporation and its component companies are in a position to monopolize radio broadcasting, and there is a well defined impression that the profit margin on vacuum tubes is high.

On the other hand, the Western Electric Company, the American Telephone and Telegraph Company, the General Electric Company—are constantly engaged in research work of first importance. Such achievements as the broadcasting over the entire country of Mr. Wilson's Armistice Day speech, of President Coolidge's Message to Congress, are epochal; they are a distinct and vitally important contribution to knowledge and to social progress. Such an achievement as the recently announced mercury boiler, with its promise of doubled power efficiency, is not incidental; it is revolutionary, and of incalculable benefit to all mankind. But these achievements are the product of research, and research of this kind is expensive.

We need to discriminate, to appraise, to *think* —before we rush into a characteristic popular brainstorm of reform agitation.

Should we legislate all big combinations out of existence merely because they are big, and because some of them possess the power to do harm? No doubt the price of telephone service or of vacuum tubes could be lowered—but this would mean only small savings to a relatively small proportion of people.

Is it wiser to abolish all monopolies and to restrict profits to a predetermined percentage, or is it wiser to foster benevolent monopolies and combinations and to permit large profits for the sake of the progressive research which these profits make possible?

There is occasion for thought on this problem. It is one which has furnished perennial ammunition for the political spellbinder. The reception accorded to Secretary Mellon's clear, concise analysis of the tax reduction program and the soldier bonus, however, indicates that popular opinion is at the mercy of the spellbinder only so long as there is no leader capable of presenting a logical, well reasoned array of *facts*.

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Planning the N

The Part that Building Design Pla

BY GEORGE (NIM

IN the growth and development of mankind, one of the most interesting features is the fact that mechanical inventive ability did not appear to any material extent in the make-up of human character till our own modern times. After Adam and Eve moved out of the Garden of Eden and started the three basic industries of providing food, clothing and shelter, there never was a time during all the thousands of years which followed when man showed to any comparable extent that mechanical inventive ability which is now and has been during our own times a general characteristic of the people of Europe and America. Why this ability to invent machines and harness the ning forces of nature to do the har of the work should have been held back by th during all these years and then lines suddenly develop among the peo neans ple of our own times is one of the if the mysteries of the growth and hat development of mankind. as, as

No doubt each age in the its scheme of creation has its part mos to play and there seems to be no tur question but that the part which fo our people were intended to take g is, in the main, the development h of science and mechanical inven enti tions. The only question which th arises sometimes as to how well ans we have served humanity in ap the plying this wonderful inventive me genius is whether or not we have played fair with posterity by

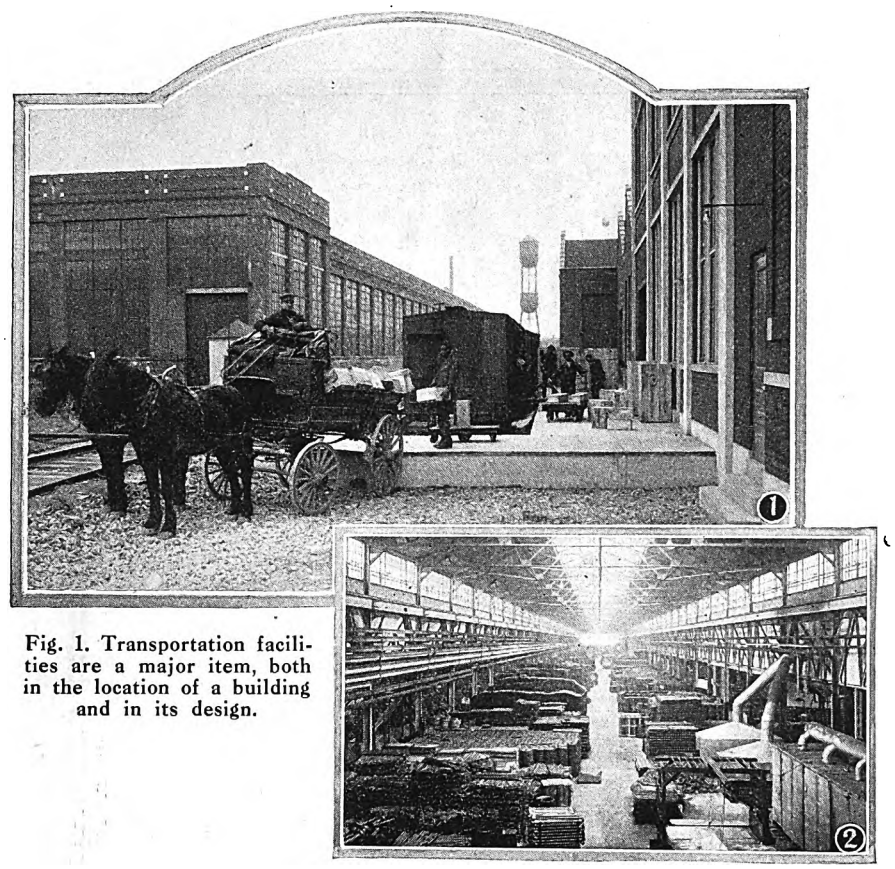


Fig. 1. Transportation facilities are a major item, both in the location of a building and in its design.

Fig. 2. It was the demand for unobstructed wide areas, which led to the design of structure now so often encountered in the case of storage warehouses outside the congested districts.

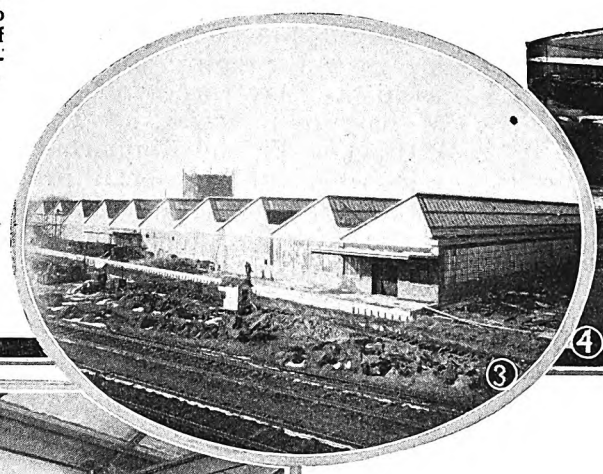


Fig. 3. With plenty of ground, the single-story, saw-tooth roof offers good natural light and ventilation, at comparatively low cost if the process does not demand much overhead room.

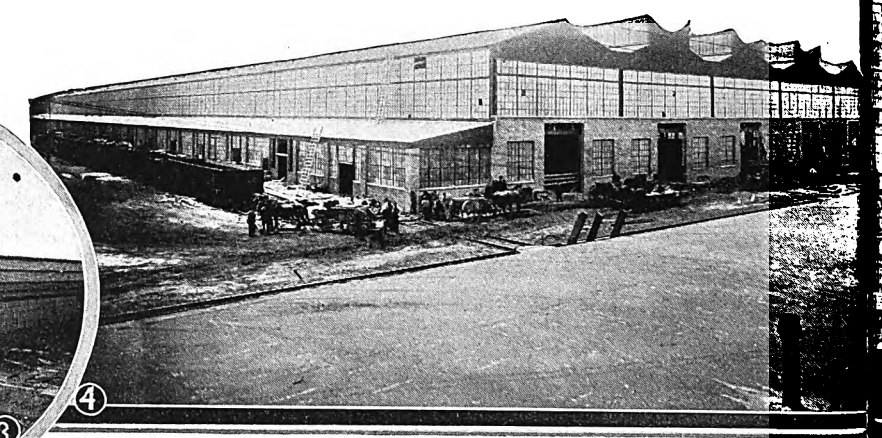


Fig. 4. Here, with much greater headroom than in Fig. 3, we still have maximum daylight and ventilation provided for in the design.

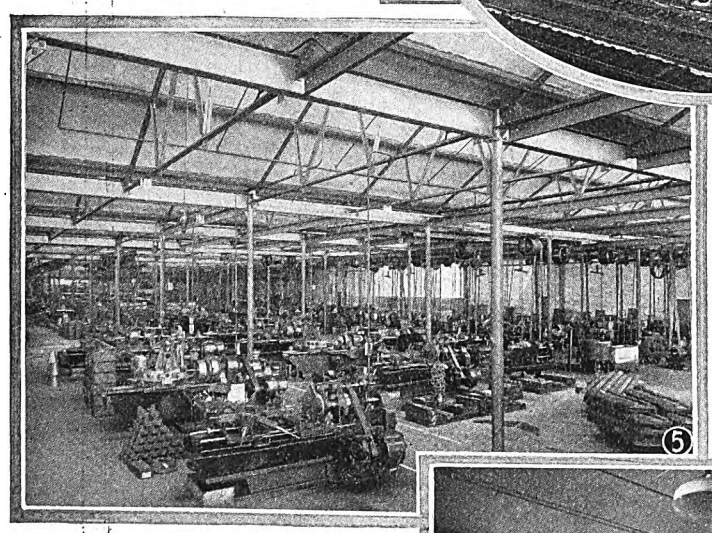


Fig. 5. In certain manufacturing processes, upright columns are useful; in others, they are to be tolerated only as a necessary evil. These factors should be considered in advance.

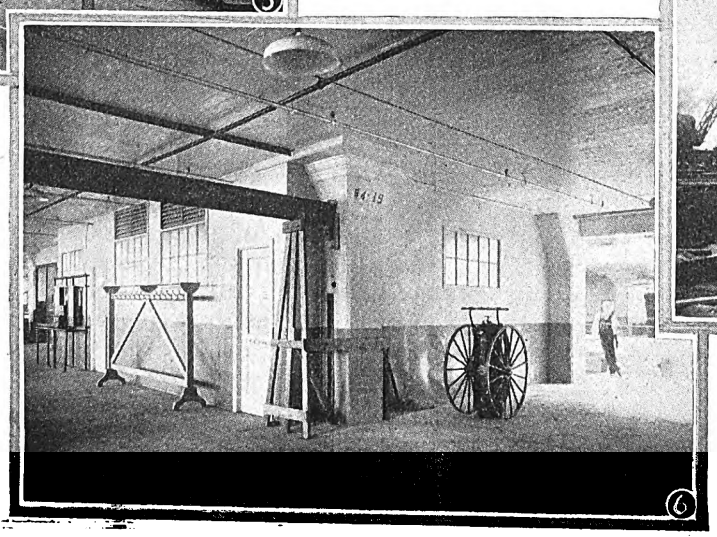


Fig. 6. Fire prevention (and lower insurance rates) is not a result of afterthought, but should be made a part of the plan of the building itself.

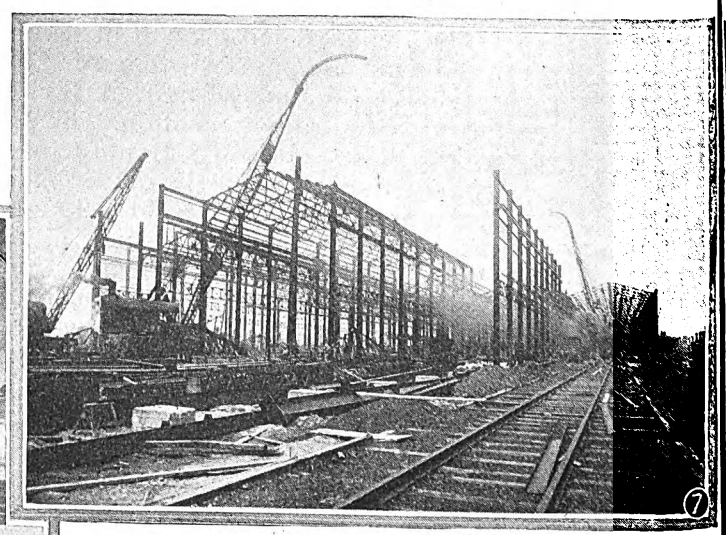


Fig. 7. Every column and girder, every truss, every rivet-hole, has to be planned for in the design; and the "anatomy" of the structure determines whether it shall be an asset or a profit-consuming liability.

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New Building

Plays in Modern Production

IMMONS, F. A. I. A.

sing up more than our share the resources of the earth. y the use of our powerful ma- hines and our extraordinary eans of transportation, we act s if we owned the earth and hat its supplies were only for s, as we are stripping it of some f its essential raw materials at most alarming rate. What the uture generations are going to o for fuel, minerals and build- ng material is a problem. Let s hope that our wonderful in- entive genius will continue on n the race and solve their prob- ems just as it has solved ours. he least that the people of our me can do in the meantime, as a small recompense for this apparently selfish consumption of the resources of the earth, is to hasten the enactment of proper laws for reforestation and for the conservation and prevention of the waste of many of the other essential resources.

The invention in rapid succession of the steam engine, the loom and a host of other industrial machines was the cause of the beginning of the modern factory system. Home industries, such as weaving, shoe making, furniture making, etc., gave way to the factory product.

The history of the factory re-

(*Continued on page* 41)

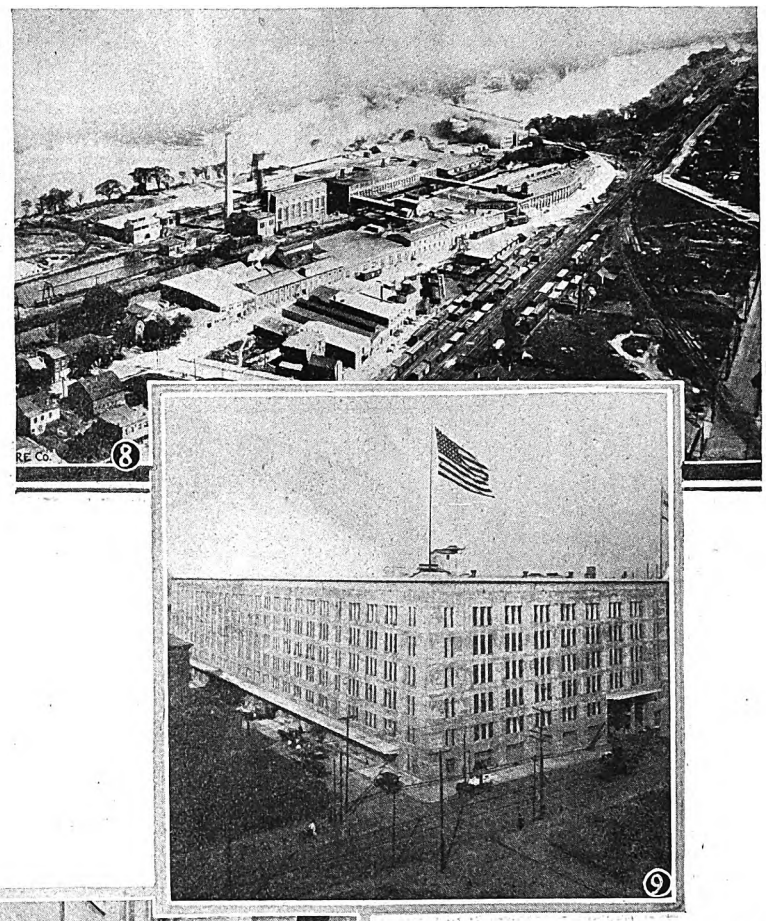


Fig. 8. Locating the site with due regard to land values, transportation facilities, nearness to markets, and character of buildings required—this alone is a major problem.



Fig. 11. The difference in cost between an ugly, box-like structure, and one of architectural beauty, is such a small percentage of the total as to make the latter well worth while.

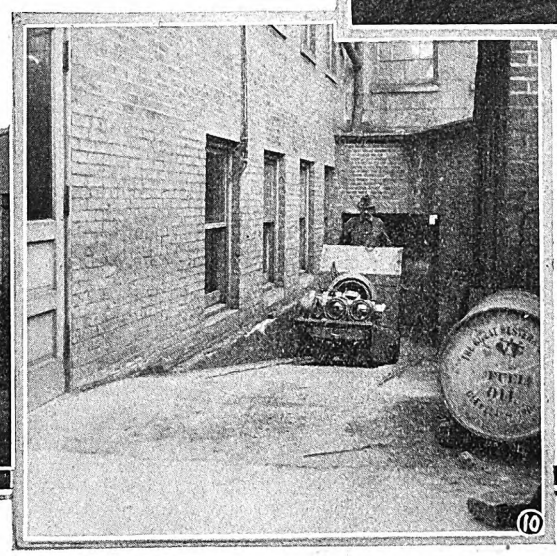


Fig. 10. Inter-factory and intra-factory transportation should be considered in the original plan, as many executives have learned to their cost, in this modern day of materials handling science.

Fig. 9. A warehouse is usually considered strictly in the light of its utility; but this illustration of a thoroughly practical Brooklyn, N. Y., warehouse, proves that there is no need to make it a blot on the landscape.

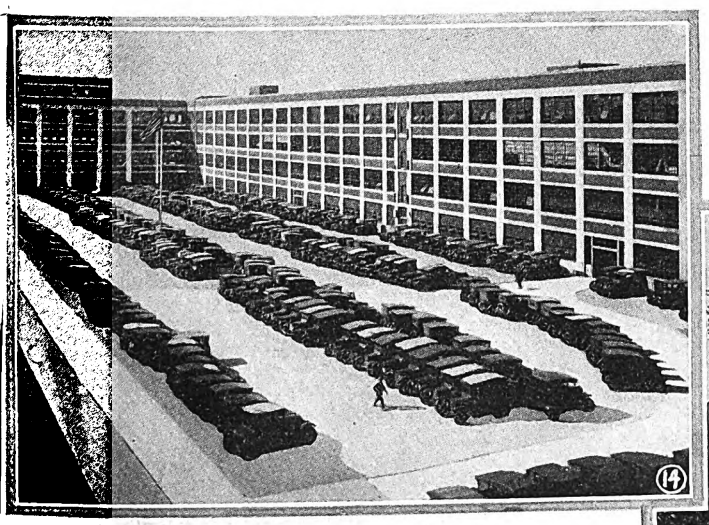
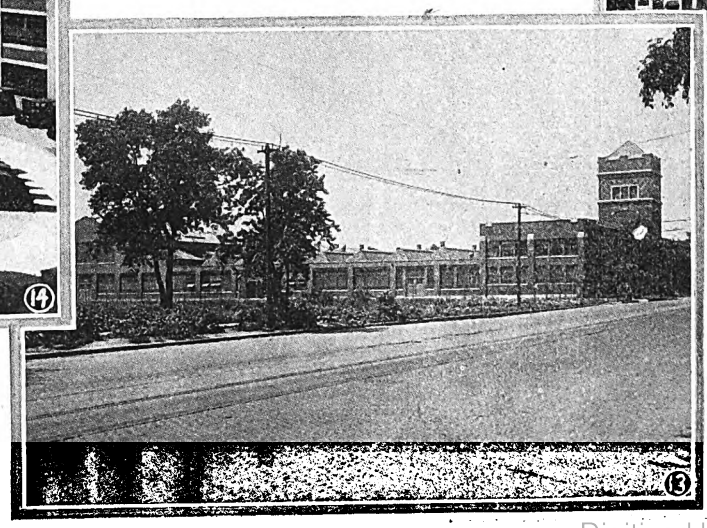


Fig. 14. One of the newer factors which has had to be taken into consideration: parking-space for the employees' cars.

Fig. 13. Below is another case where the owners realized that architectural beauty pays, in increased good will and in better morale, to an extent far outweighing the slight extra cost.



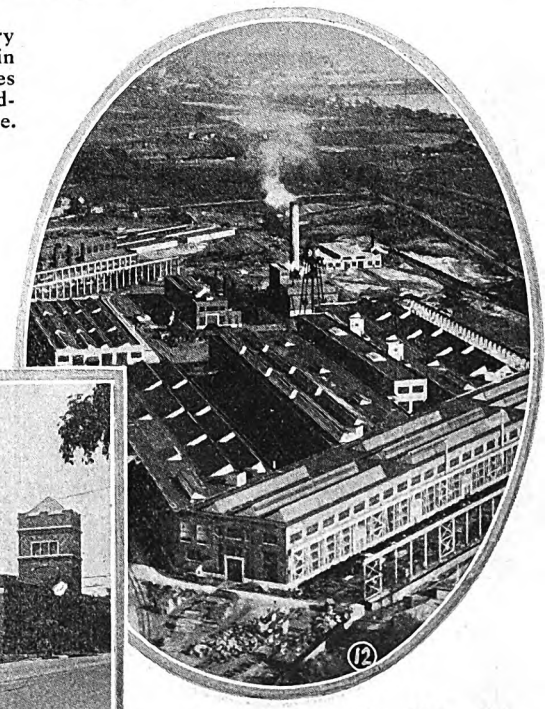


Fig. 12. It may make all the difference between profit and loss, to have the individual buildings of a plant so arranged as to make for straight-line production—with future additions already planned and fitted into the major plan.

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What Paint Means to Maintenance

Protection, Appearance, Identification and Illumination—All Depend Upon Paint

By William G. Ziegler

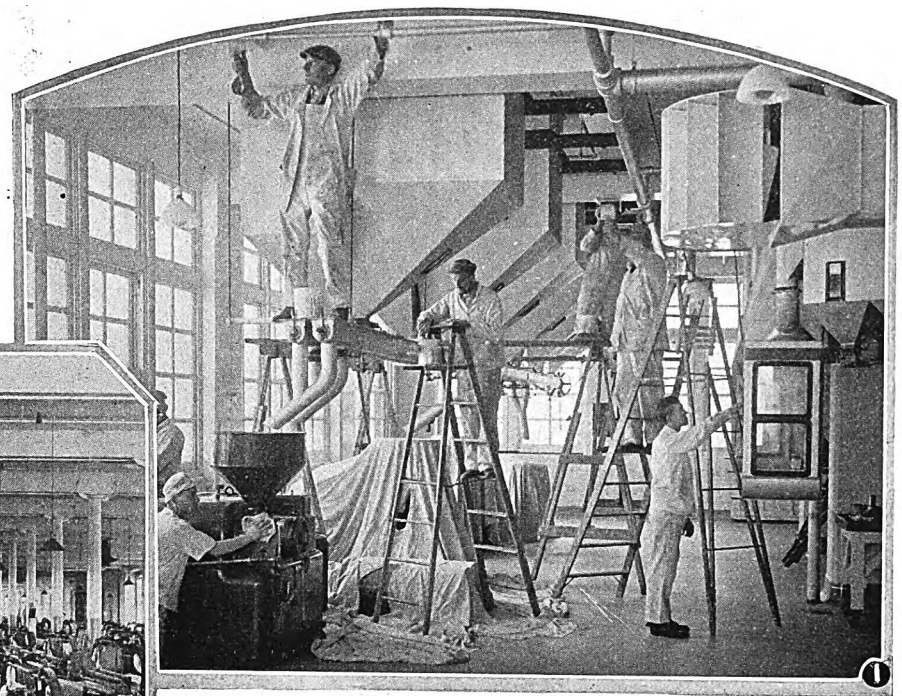


Fig. 1. A department can be transformed almost overnight by putting a well-organized force on the painting job. The results will be immediate in increased production and comfort.

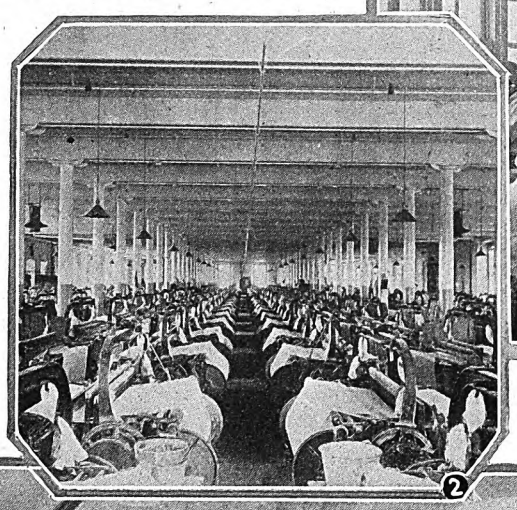
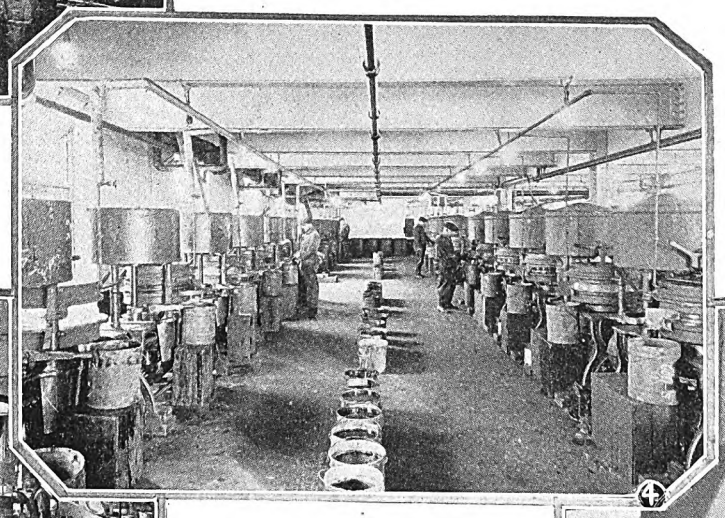
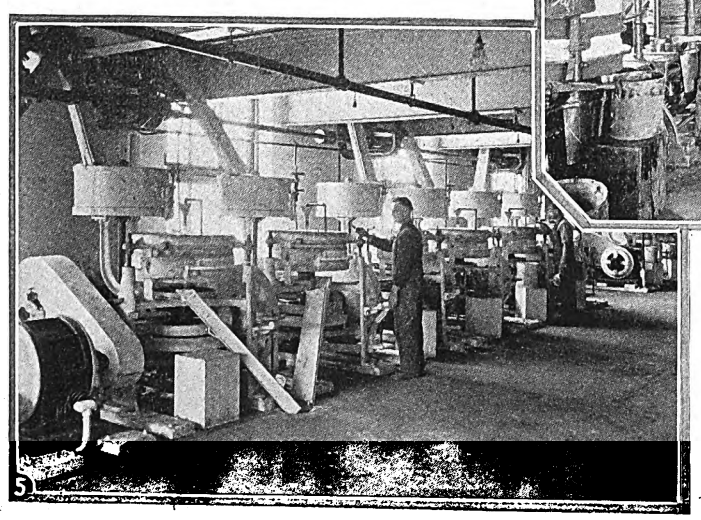


Fig. 2. Wide bays and low ceilings add to the complexity of the lighting problem. Proper painting, as in the textile plant below, helps to solve this problem and to save many dollars worth of electricity.

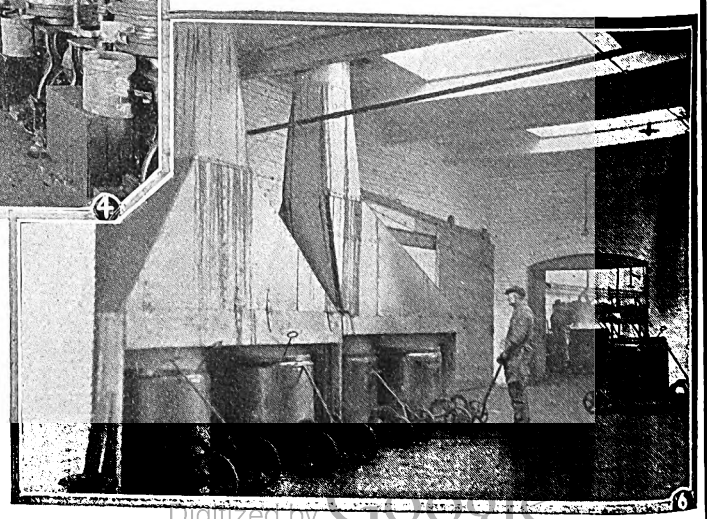


Fig. 3. Not only is the daylight effect of properly painted ceilings a distinct source of economy in making the most of light which comes through the windows, but in addition it tremendously multiplies the effectiveness of artificial lighting.





Figs. 4, 5, and 6. The production of modern paint is a highly technical process combining scientific research and discovery in chemistry, physics and mechanical engineering. These three pictures give an idea of the mechanical equipment of some of the departments in a modern paint-making plant.



TIME and money spent on painting the plant and its equipment will pay dividends in keeping the plant fit, and thereby enable it to go on year after year earning a profit for the owner. For let it be remembered that a plant depreciates rapidly unless a regular and systematic effort is made to slow up or eliminate deterioration. A small amount spent each year on painting the plant and its equipment is an excellent investment, and in the long run it will be found to be much cheaper than neglecting to take care of things. Sooner or later this course will necessitate replacing things at a large cost. As in other maintenance work the use of high grade materials for all painting will be most economical. Painting does not add to the value of the plant, if it is assumed that the plant has always been in good condition but it tends to keep the plant at the same value each year by slowing up depreciation. However, most accounting departments consider painting as a repair and not as a betterment. In the case of alterations or extensions which are considered as betterments, the painting will naturally be a part of the job and considered a betterment. This painting should be done as soon as the job is finished. Unfinished surfaces look badly and tend to lower morale.

Properly painted factories reduce the cost of lighting due to

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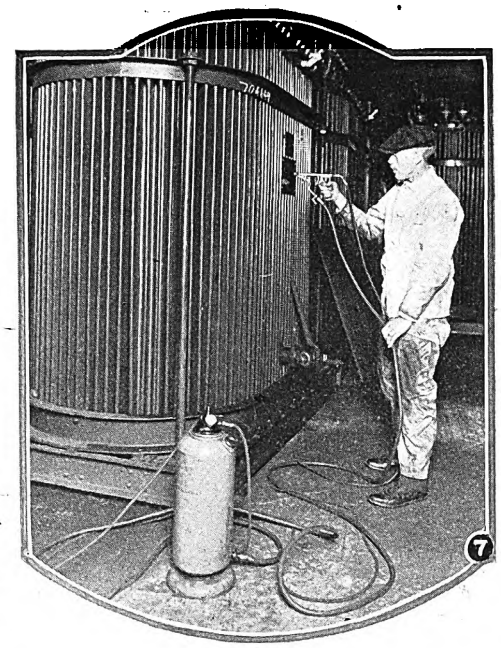


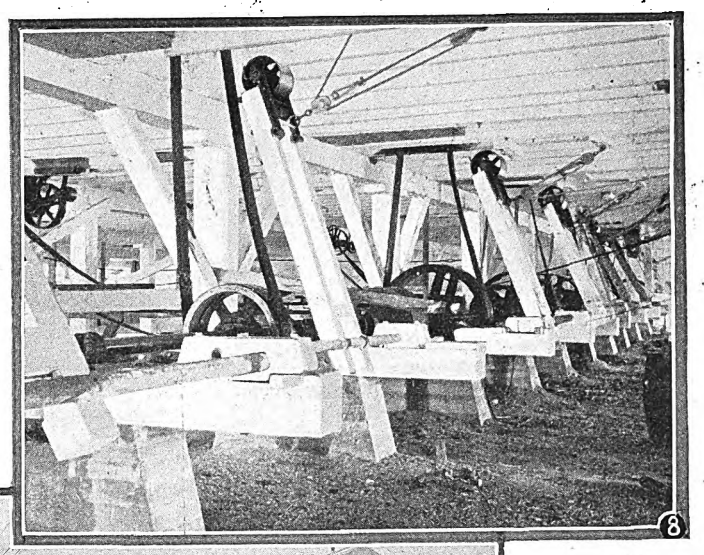
Fig. 7. The atomizer principle has made it possible to effectively use "air instead of hair" in applying paint to various surfaces. The advantages are particularly apparent where these surfaces are recessed or irregular and difficult to get at with a brush.

the fact that the white ceilings and walls reflect all the light back onto the work. Proper painting also speeds up production, because with good light there will be less eye-strain and less spoilage, and the men will be able to accomplish more. A distinct improvement in the quality of the product will usually follow any improvement in the painting of walls and ceilings, and a reduction in the number of accidents will usually follow.

For permanent jobs the so-called oil paints should invariably be used, as they have greater reflecting capacity and are permanent. Cold water paints and whitewashes are often used on jobs of a semi-permanent nature or in basements or other such places where the object is to make the surface white at the lowest cost. Cold water paints have good hiding power, and they are cheap, but they are not to be recommended where a permanent finish is desired. They should not be used on concrete surfaces where high humidity exists, as they may mildew and spot large surfaces.

In connection with applying any of the so-called prepared oil paints, it should be remembered that to get the best results, thorough stirring is necessary. The pigment must be thoroughly

Fig. 8. Fire risk is reduced and an impetus to cleanliness provided where heavy timbers or transmission framing is made smooth and white by proper painting. Liability to accident in places such as this is also materially reduced through the better lighting secured.



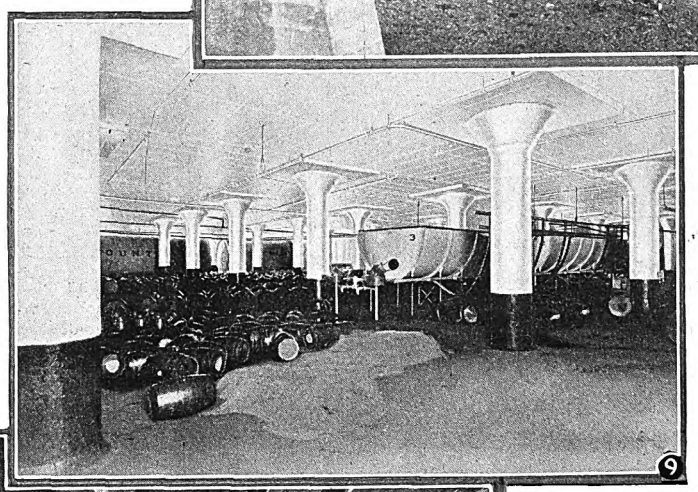


Fig. 9. Cleanliness is as desirable in industry as at home and nowhere more so than where food products or beverages are made. Note the spic and span effect of this storage department in one of the Coco Cola bottling plants.



Fig. 10. Modern industrial plants contain thousands of feet and often miles of air, steam, gas, sprinkler, city water and other pipes. When the emergency comes the repair man knows exactly what he is doing if the pipes are distinguished according to service by suitable colors.

Fig. 13. Portable air compressing units for use in paint spraying are available and particularly useful in plants or departments not served by stationary air compressors. Below is shown an outfit of this sort in use.

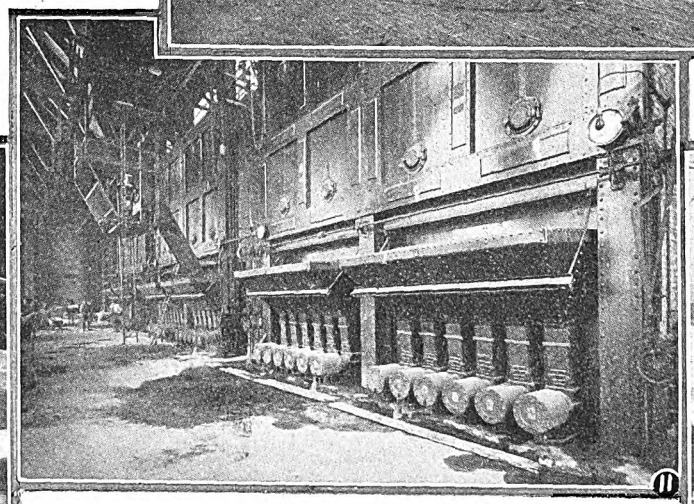


Fig. 11. So far as painting is concerned perhaps the most neglected part of the average plant is the boiler room. The proper painting of boiler fronts, steel work, steam and water piping and concrete floors, is a distinct aid in maintenance and in reducing depreciation.

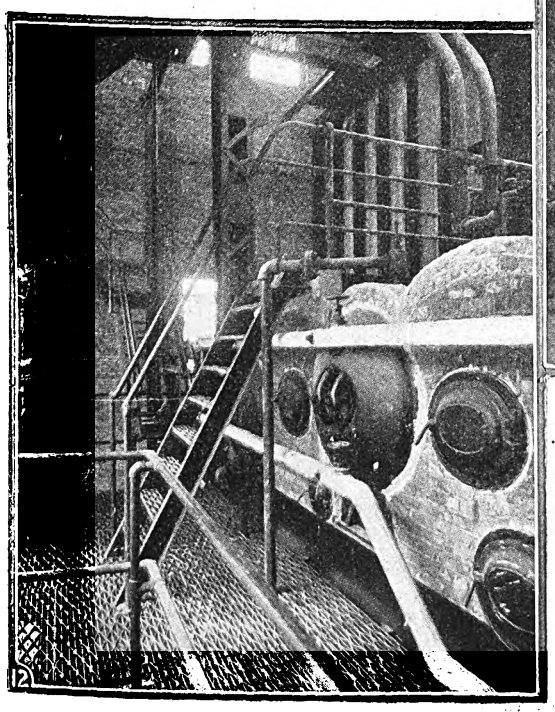
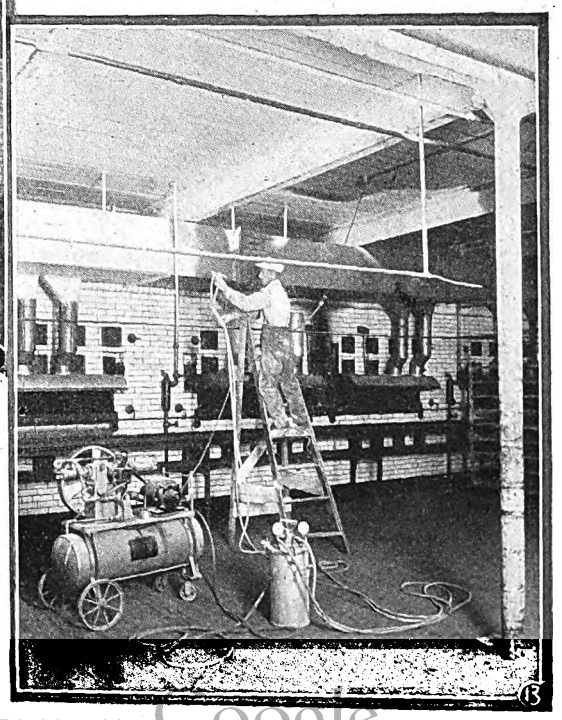
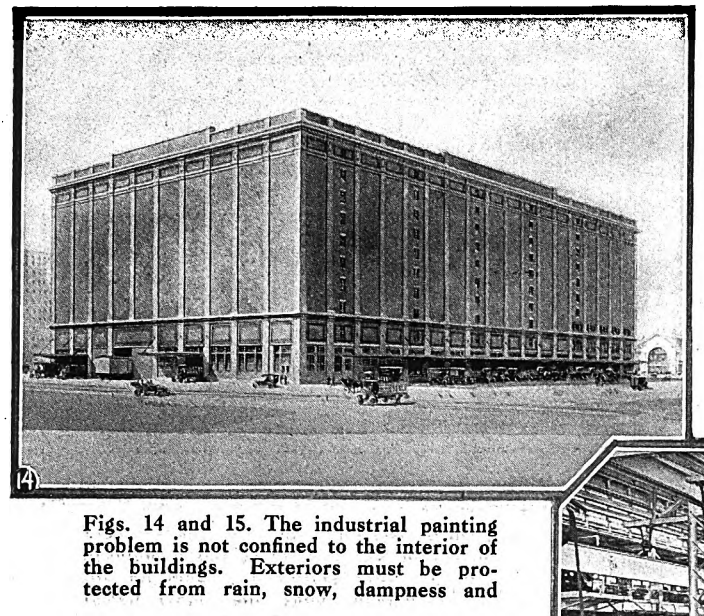
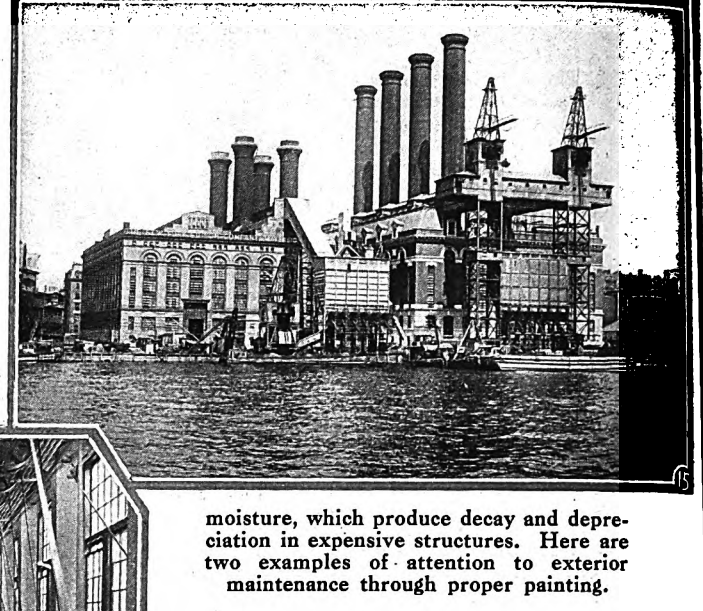


Fig. 12. In the power house of the Cadillac Motor Car Company, of Detroit, attention is given to proper painting which includes a definite color scheme for identification of various pipe lines.



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Figs. 14 and 15. The industrial painting problem is not confined to the interior of the buildings. Exteriors must be protected from rain, snow, dampness and moisture, which produce decay and depreciation in expensive structures. Here are two examples of attention to exterior maintenance through proper painting.

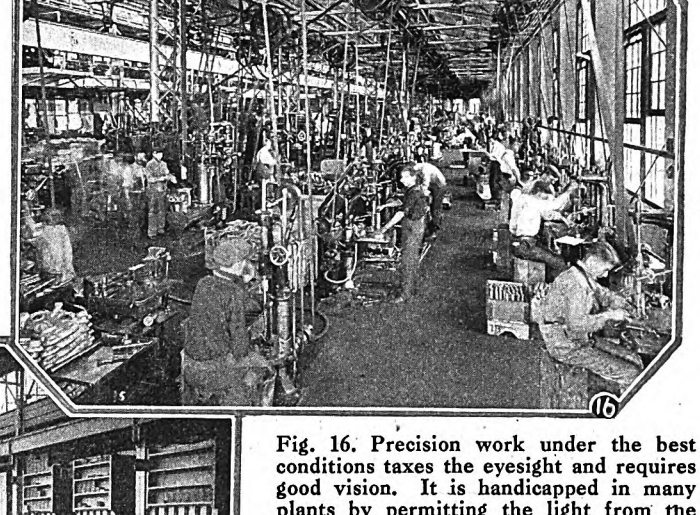


Fig. 16. Precision work under the best conditions taxes the eyesight and requires good vision. It is handicapped in many plants by permitting the light from the windows to be absorbed by dingy walls and ceilings. Not so in this machine department, however, where proper painting is considered a necessary part of production.



Fig. 17. One can tell from looking at this picture that the plant represented is in capable managerial hands. Most store or stock rooms are neglected so far as paint and light are concerned, but not this one.

mixed with the liquid so that the paint will be the same consistency throughout the job. If not properly mixed the paint will be too thin at the start of the job and will probably run, and will not hide the surface. The best way to stir is to have an empty can or tub half the size of the one being opened. Dip out or pour off most all the liquid into the empty vessel. Then with a good broad paddle stir the thick portion in the original container until it is of a uniform consistency. Then gradually pour back the liquid, stirring each batch into the pigment before another is added. In this way the paint will be thoroughly mixed and will give the best results.

The light reflecting capacities of various kinds and colors of

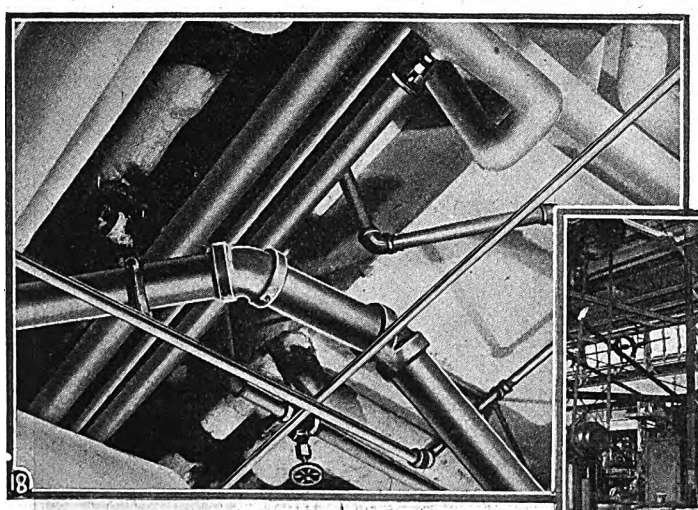
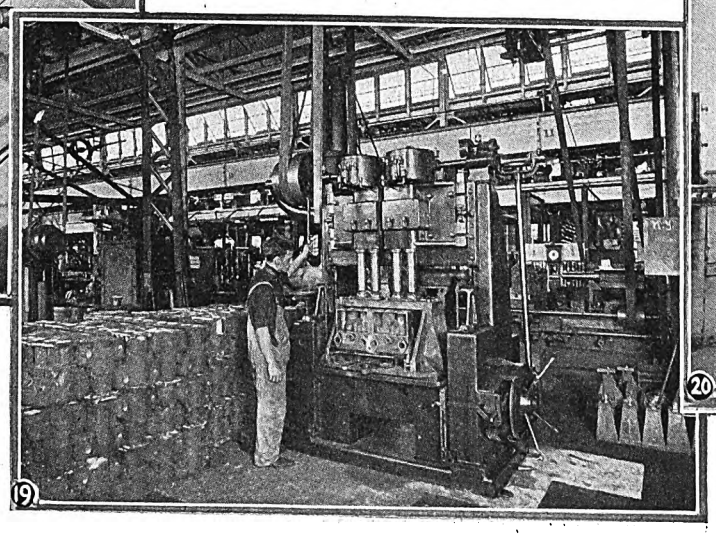


Fig. 18. This is a puzzle picture in black and white, the problem being to tell which pipes are "which"—oil, gas, air, steam or water. Actually, however, it is not difficult, for each one has its own distinct color which proclaims its purpose without hesitation or uncertainty.

Fig. 19. The average man takes pride in the spic and span appearance of his automobile. This same spirit applied to the machine tools in a factory indicate that the manager takes pride in his equipment. Painting machinery and keeping it spic and span has a distinct effect on the operator too.



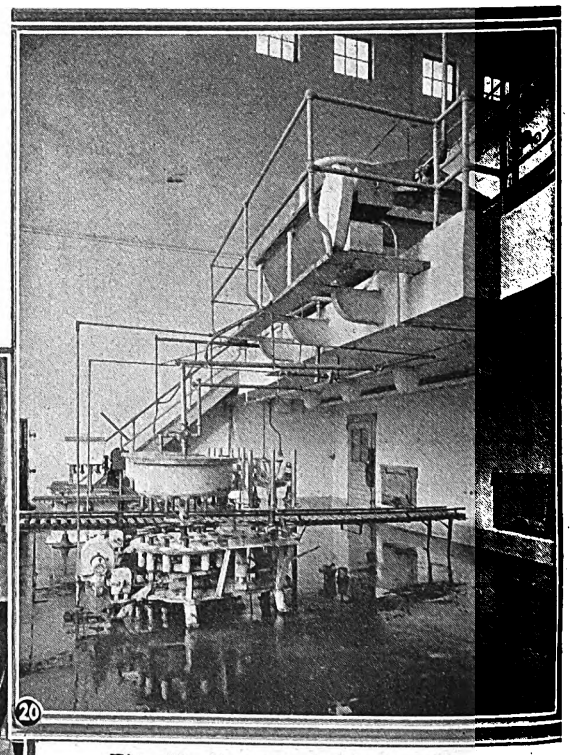


Fig. 20. Concrete balconies, interior walls and other structures of this material, when properly painted, not only reduce the cost of lighting and make a most attractive appearance, but will undergo less wear and tear.

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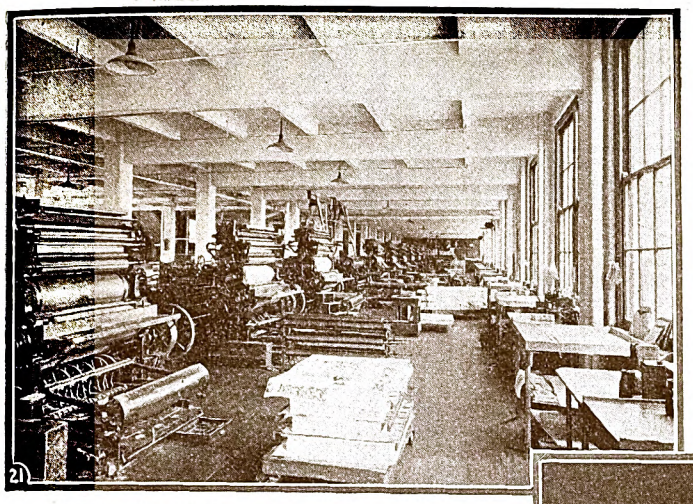
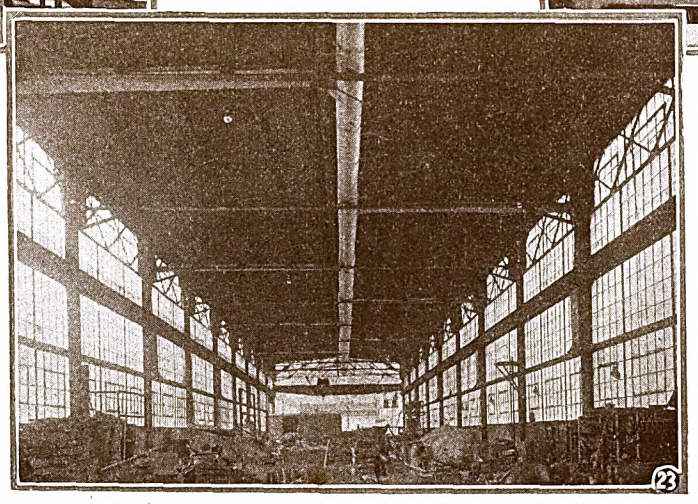


Fig. 21. Good light and cleanliness add to the efficiency of producing printed matter. Many print shops are horrible examples of poor painting and dirty windows. Not so in this picture which shows a department in the Henderson Lithographing Company, of Cincinnati.



Fig. 22. Another department of the same lithographing establishment is shown here. Note how the daylight through proper painting penetrates clear back to the stock racks at the right.



Figs. 23 and 24. Just what painting will do in the way of increasing lighting effect is well illustrated in these two pictures which show two departments in the plant of the Cleveland Crane and Engineering Company. (Compare this with Fig. 24 below at the right.)

paints have been carefully measured and charted. Mr. H. A. Gardner, of the Institute of Industrial Research at Washington, has made extensive tests on the reflective capacity of many kinds and colors of paint. It was found that on a basis of .98 for the coefficient of reflection for a block of white magnesium carbonate that the commercial white industrial paints for inside use have coefficients of reflection ranging from .74 to .82. These figures are very high compared with similar kinds of paint sold several years ago. It is evident that the increase in the reflecting value of the modern industrial white paints has been the result of years of research.

The cost of artificial lighting is inseparably tied up with the light reflecting values of the walls and ceilings, and it is evident that the cost of lighting can be reduced by keeping walls and ceilings well painted with white paints which preferably can be washed down. The shallow bowl reflectors used on the large general lighting units in the factory allow a large percentage of the light to travel in a horizontal direction. This light is reflected and diffused when it hits the nearest wall or column, and in that way influences the illumination besides making the room appear larger and more cheerful. Executives are coming to recognize that cheerful surroundings tend to make the employees contented and in time should tend to increase both the amount of the product delivered and also better its quality. White paint on ceilings and walls is probably the most important factor in solving any problem of lighting. Surely it will be admitted that without white paint as a contributing factor any artificial lighting problem will be harder to solve. Where indirect lighting with opaque bowls is used, a white ceiling to reflect and diffuse the light is absolutely essential.

There are several other qualifications which a paint should have in order to be of maximum service in interior plant painting. We all think first of light reflecting capacity as a major qualification and it is well that we do so. However, there are

(*Continued on page* 32)



Fig. 26. Good maintenance management requires that a department be well painted, not only when it is new but that it be kept well painted as long as it is in use. Here is a good example of modern painting practice.

Fig. 25. Ordinarily roof trusses of this sort made of heavy timber help to produce a dark shop because of light obstructing qualities. These are offset, however, by proper paint, as is evidenced by this interior of the Canton Bridge Company.



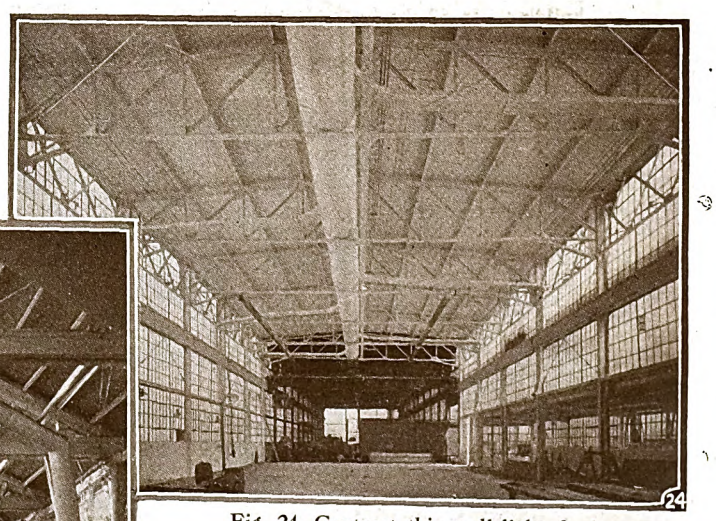


Fig. 24. Contrast this well-lighted, cheerful interior with the rather forbidding aspect shown above (Fig. 23)—solely a matter of intelligent application of paint.

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Building 50,000-Horsepower Turbo-Generators

A Plant Whose Products Dwarf the Men Who Make Them

By John H. Van Deventer

At Schenectady a ten thousand horsepower turbine-generator set is the smallest built. The smaller units are built at the Erie, Penn., plant. In the three great buildings at Schenectady devoted to this work, more than a thousand men are continuously employed in machining parts, and erecting and testing sets ranging in size from ten thousand to eighty thousand horsepower—this latter being the largest yet built. Turbines of fifty thousand horsepower rating are comparatively common in these works.

Measured in gross volume of sales per annum, turbine-generator sets form the chief product of the General Electric Company's Schenectady Works. The growing average size of the individual units and the magnitude of the business as a total, are striking proofs of the rapid development we are now experiencing with regard to the increased generation of power and its utilization.

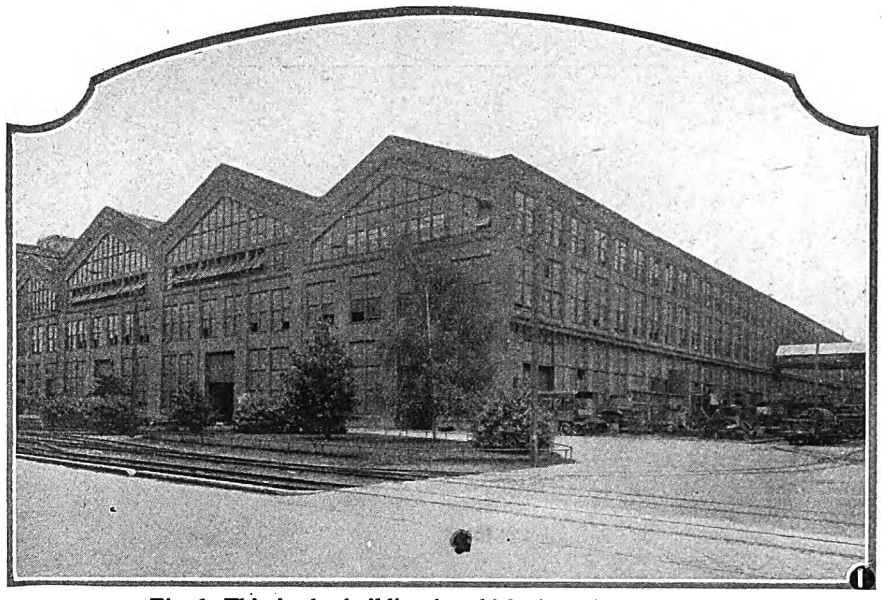


Fig. 1. This is the building in which the principal operations of machining and erecting huge turbine generators are carried out. It is known as Number 60 and is 800 feet long and 340 feet wide. It contains nearly 1,000 machine tools and 35 overhead cranes.

Advanced engineering and skilled production are the two big *internal* factors in the development of the modern large capacity turbine-generator. The ever increasing demand for more power on the part of the industrial world and the private citizen is the big *external* factor. Probably in no other line of engineering is a more diverse and highly specialized accumulation of knowledge, theory and experience required and certainly in no other kind of apparatus building are the production problems of more magnitude or more difficult to solve.

Engineering, mechanical and electrical, is called upon to exert its utmost in behalf of the modern large capacity turbine generator unit. A sharp division in this engineering work is drawn between the steam and the electrical ends of the unit, each of which requires its staff of highly trained experts.

The engineering problems of the steam end are complicated by a number of unusual condi-

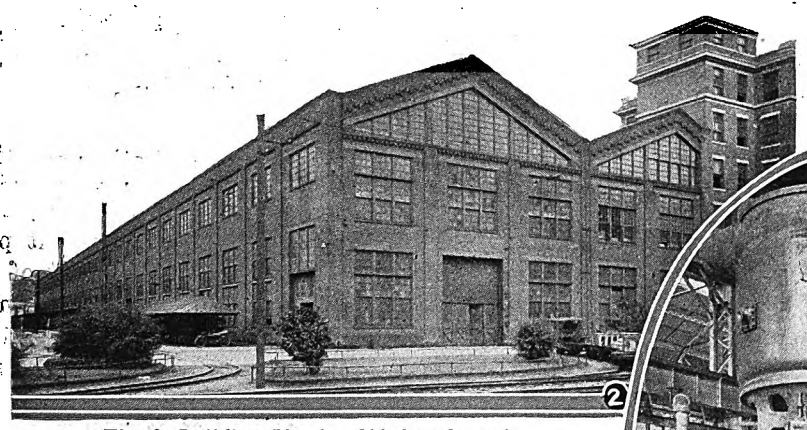


Fig. 2. Building 52, also 800 feet long, is parallel to building 60 and connected to it at one end by a six-story administrative building. In 52 the huge electric generators which form part of the turbine generator set are wound and assembled.

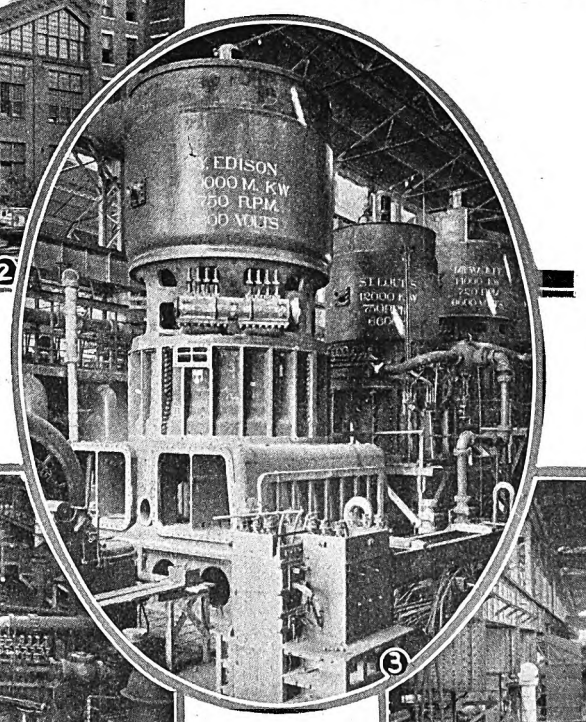


Fig. 3. Five years ago or more the interior of building 60, at the erecting floor, looked like this. In those days "vertical" turbines were the rule. A 20,000 kilowatt unit was considered a monster.

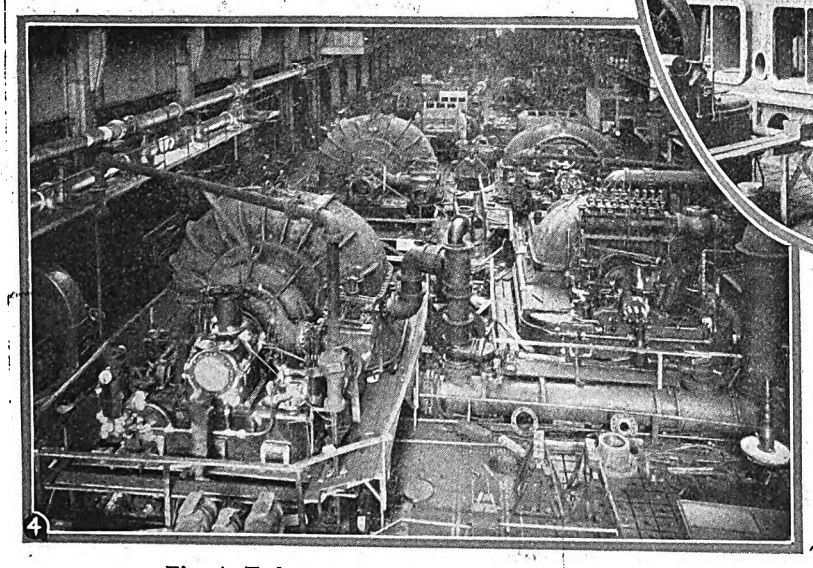


Fig. 4. Today the large units are "horizontal" and the size has enormously increased, 50,000 and 60,000 kilowatt sets being not at all uncommon. If made vertically in these sizes they would extend too far up in the air.

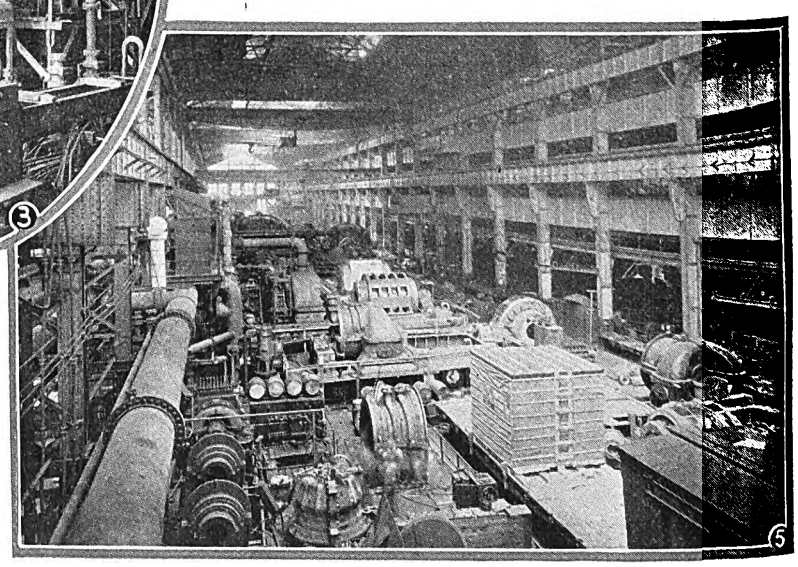


Fig. 5. There are two main bays in building 60 and three side bays, two of which have double mezzanine floors. The main bays house the huge machine tools—some of the largest in the world—and also the test floors. This is a view of the east bay from the south or shipping end.

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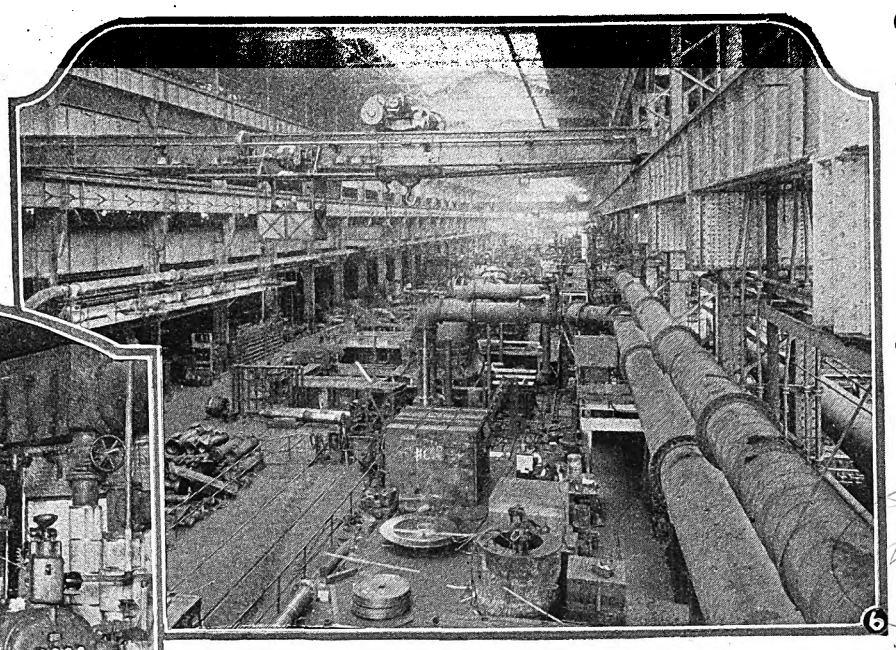


Fig. 6. A similar view of the west main bay is shown here. Standard gage railroad tracks enter both of these bays, so that the completed units have adequate crane service for loading them upon flat cars.

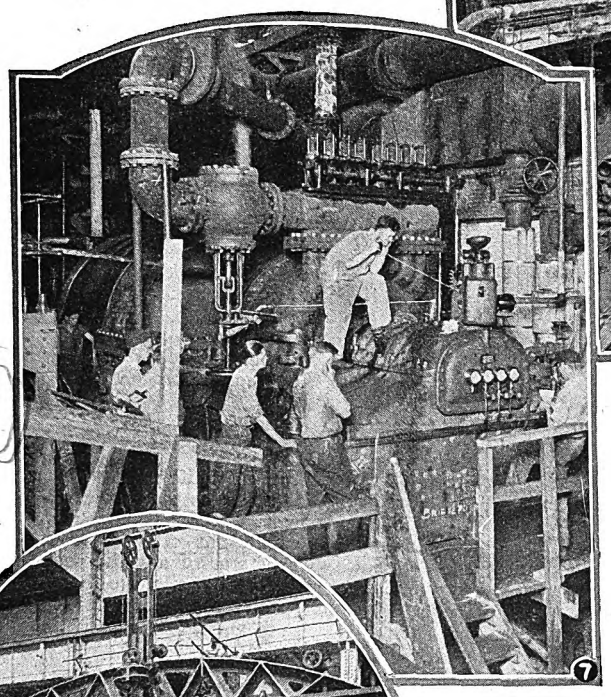


Fig. 7. Elaborate and careful tests are made of each completed unit. Young engineers are shown here testing a steam turbine and at the same time adding a store of practical knowledge to their technical education.

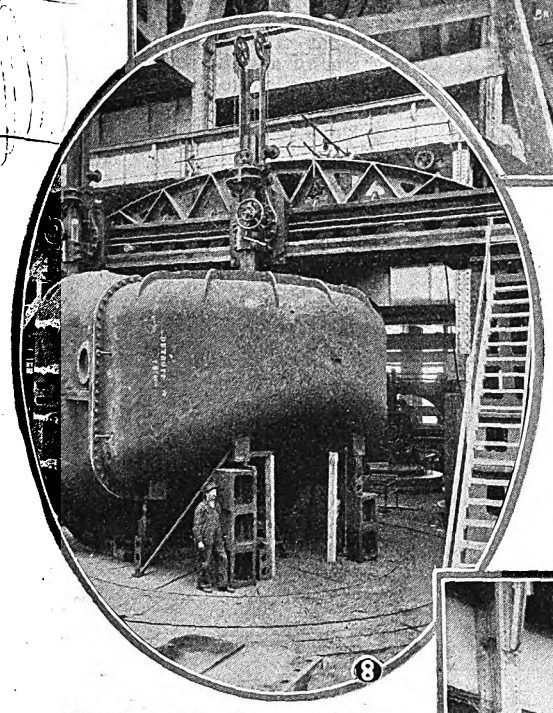


Fig. 8. Here's where machining becomes a matter of weeks and months instead of days or hours. Castings of thirty and forty tons in weight are not uncommon and present their own difficult problems in handling and setting up.

tions, each of which would be difficult individually of solution and which in combination are most perplexing. The high rotative speeds produce stresses far beyond those encountered in ordinary engineering practice. They call for the use of materials of enormous strength. They call for the most unusual precautions in the way of engineering tests, not only for strength, but for balance and vibration. They call for the detection of unseen flaws which may hide within the steel forgings used for bucket wheels, and which are detectable only by the mysterious sensibilities of the magnetic analysis machine which unerringly points to the interior blow-hole of impurity. They call for such unusual and difficult engineering feats as that required to compensate for the more rapid heating and consequent expansion of the comparatively thin bucket wheels which actually draw away from the comparatively heavy shaft on which they are mounted during periods of initial heating. They call for elaborate tests to determine whether the natural periodicity of vibration of bucket wheel discs and even of the long bucket blades of the low pressure stages, will coincide with the operating speed and hence cause vibration or chatter.

The high steam pressures, low vacuum and high superheat introduce an additional set of perplexing engineering problems. Cast iron no longer suffices for high pressure shells, and so we find huge steel castings, the sections three inches thick and with seven-inch bolting flanges, imprisoning the tremendous bottled energy of fifty

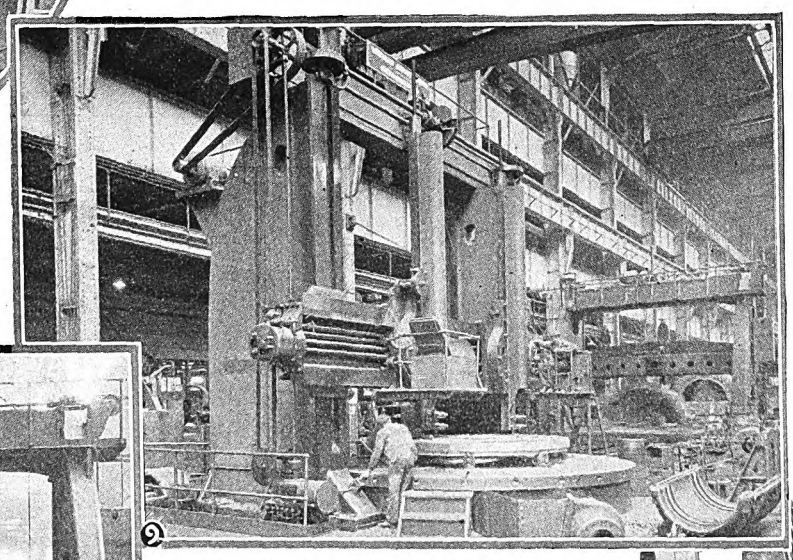


Fig. 9. Stationary diaphragms as they are called alternate with each rotating bucket wheel in the completed turbine, there being a diaphragm and a bucket wheel for each stage and from thirteen to twenty-three of each on one turbine. Above is a diaphragm on a big boring mill.

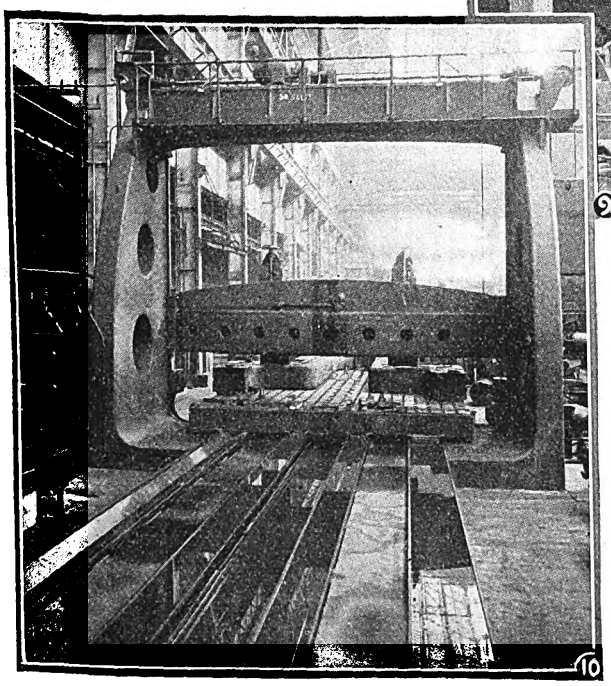


Fig. 10. The largest planer in the world in the west bay in Number 60 is kept busy planing base plates, flange joints on turbine shells, and other enormous castings. The mirror-like reflections on the ways indicate the degree of attention to lubrication.

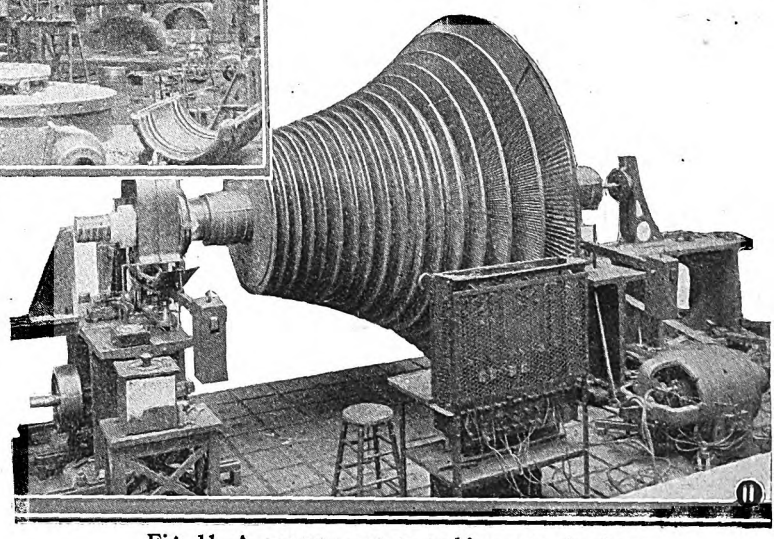


Fig. 11. A seventeen-stage turbine rotor is shown here on a balancing machine ready to receive both running and static balance. In addition each of the seventeen wheels is tested for its period of vibration both before it is mounted on the shaft and afterwards.

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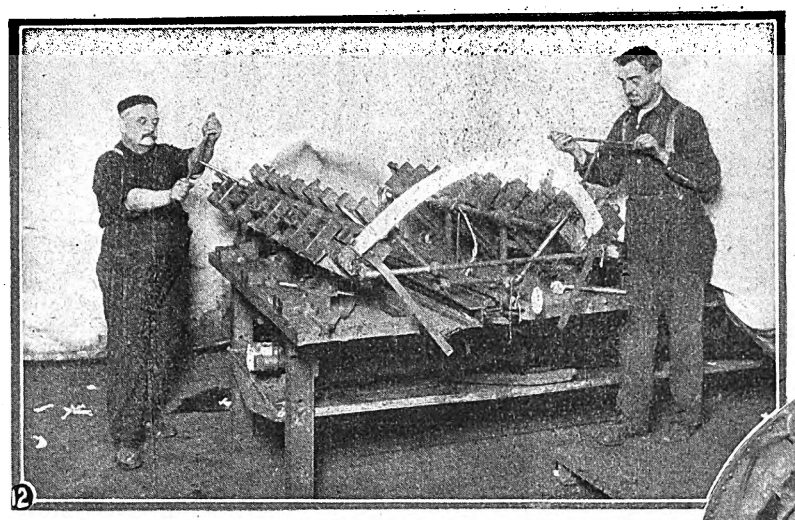


Fig. 12. Each stator coil must be hand made, wound, impregnated and baked. The use of high voltages—13,800—is common practice today and has made insulation a matter of prime importance. This picture shows a turbine generator static coil in a steam mold.



Fig. 14. Insulating compounds have been developed by special research and are made in a separate department devoted to this purpose. A portion of this department is shown above with batches of compound being made ready for use in the huge coil impregnating receptacles.

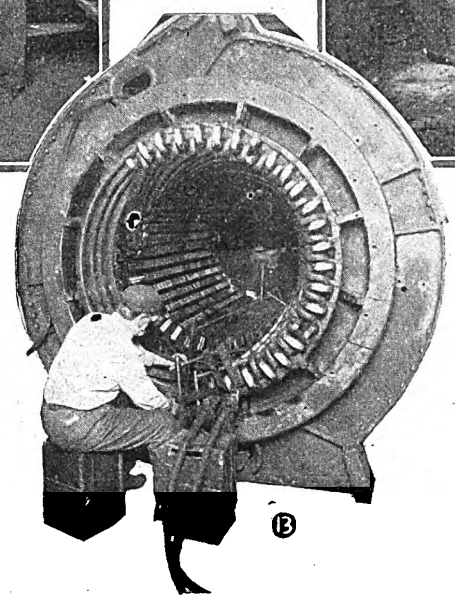


Fig. 13. The electrical half of a turbine generator unit presents as many difficulties in its engineering and production as does the steam half, but of a different kind. This is the stator of a high speed generator in which the coils are being heated and assembled.

thousand horsepower. Infinitesimal percentage savings in steam economy per horsepower, when measured in totals of annual horsepower hours, spell large totals of expenditures saved in coal, hence bucket or blade design becomes a matter of critical importance to operating economy.

In the electrical end the engineering problems are similarly complex and equally difficult. Generation of current at 13,800 volts as contrasted with the old 110 or 220 standards, has made insulation a problem only to be solved by research into the realm of new materials and compounds. Tons of copper field coils, rotating at a peripheral speed of nearly four miles a minute, point to the difficulties met and overcome in generator rotor design. A book could well be devoted alone to the subject of difficulties and obstacles successfully met by research and engineering in the design of these large turbine generators.

Four buildings are at present devoted to the design and construction of this apparatus at the Schenectady plant. The two principal shop buildings are No. 52 and No. 60, partially shown in figures 1 and 2. Building No. 60 is the most interesting of the group because it houses the principal activities. In length, 803 feet and in width 341 feet, it contains two main bays each 78 feet wide, two side bays to the east and west of these, each 70 feet wide, and an additional west bay 46 feet wide. All of these bays run the full length

(*Continued on page* 83)

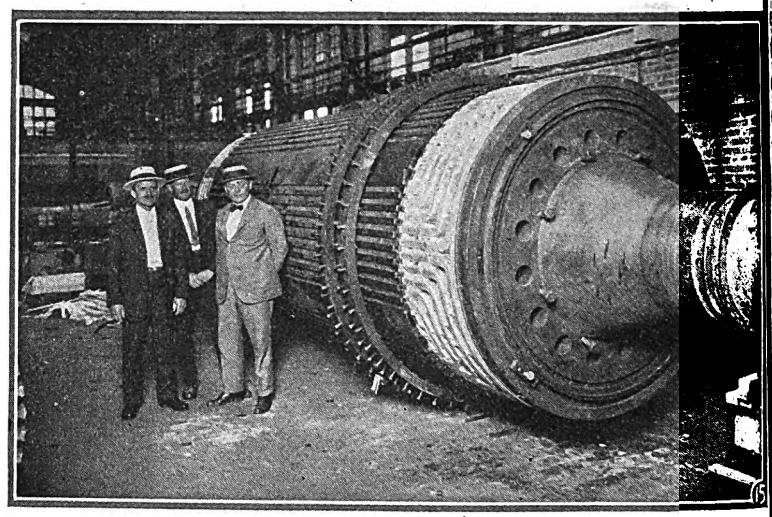


Fig. 15. The rotor or revolving field of a 62,500 kilowatt generator is shown here with its field windings in place. Huge steel bands will be shrunk over the aluminum sheaved coil ends, thus making practically a solid piece of the rotor.

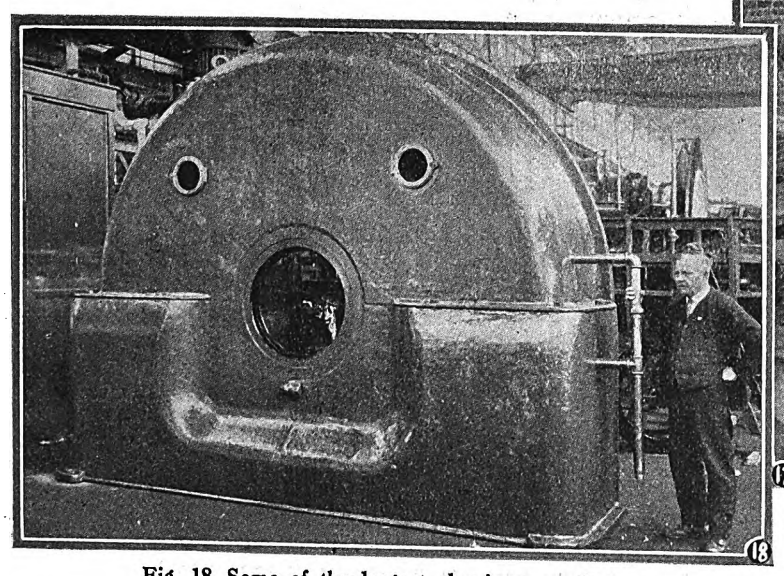


Fig. 18. Some of the largest aluminum castings ever made comprise the generator shields on a 62,500 kilowatt set. The comparative size of these is indicated by the height of the man in the above picture.

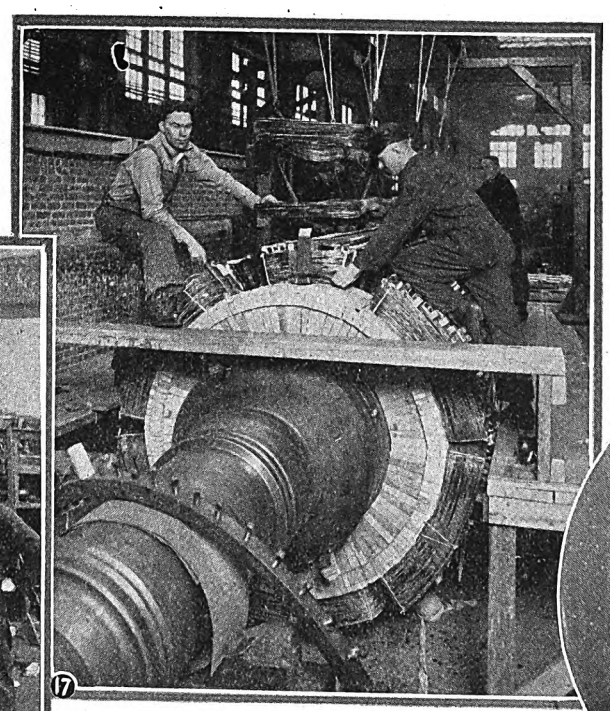
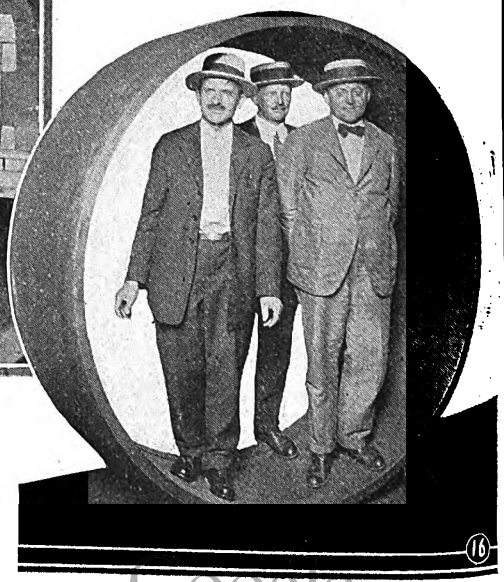


Fig. 17. Tons of copper strips in the form of coils comprise the field windings of a turbine rotor. Rotating at a peripheral speed of nearly four miles per minute the construction of these rotors calls for most advanced shop and engineering practice.

Fig. 16. A retaining ring or steel band for the 62,500 kilowatt generator. One of these is heated and shrunk on each end of the rotor.



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The Question of Crating

How Scientific Method Is Saving Money for Many Firms

By Earl Christmas

THROUGHOUT South America, there is a saying that there are three kinds of packing: "Good packing, bad packing and then American packing." A trip along the wharves of South American ports would disclose that there is considerable basis for the reflection. But you don't have to go that far away to see the tragic results of errors in packing. Any freight receiving station will bear witness to the tremendous loss from carelessness or lack of planning in packing—crates wobbly, broken or dismembered, and their contents damaged.

Unfortunately, most manufacturers don't see much of this end of the process of distribution. To many of them, the chief contact with the difficulties of shipping their goods comes when the damage claims arrive, and that, while it suggests the necessity of doing something, does not always give them the light to proceed effectively. So the order goes out to make the crates stronger, and as a rule that means more lumber.

Not a few manufacturers have stopped the damage claims, or reduced them to a minimum. How economically the results have been obtained, they have not always considered. Making crates was something for the men out in the packing room to do.

Manufacturers who are investigating the matter in a really scientific way now are being startled to find that in many cases they are using too much lumber. Engineers employed by a large lumber company, for the last year and a half, have been digging into the packing problems of big shippers throughout the country and helping them improve their crating. The tendency in the plants which the engineers have investigated is to use more lumber than necessary in crating. Almost without exception, the engineers have been able to build a better crate than the old container in use, and nearly always with less lumber.



Fig. 1. Imagine what will happen in this car when the train gives a sudden jerk or takes a curve on high speed. The battle of the boxes will be on, and victory will be for the strong. Jolts in transit and the constant weaving motion of the car wreck many weak crates.

Fig. 2. This motor was a wreck when it reached a company in Chile because an American manufacturer neglected to crate it properly for its hazardous journey.

Fig. 3. This toilet reached its destination in South America, but see—the tragic result of inefficient crating. No wonder companies in South America complain about our packing.

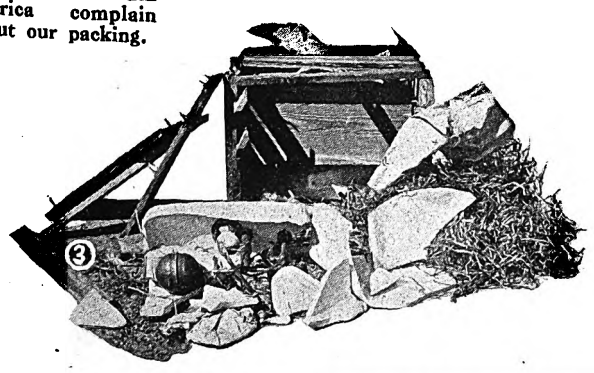




Fig. 4. This is the condition in which a box of cotton shirts and pants arrived in Chile. Yes, American packing. Imagine what a few boxes like this can do to your foreign trade!

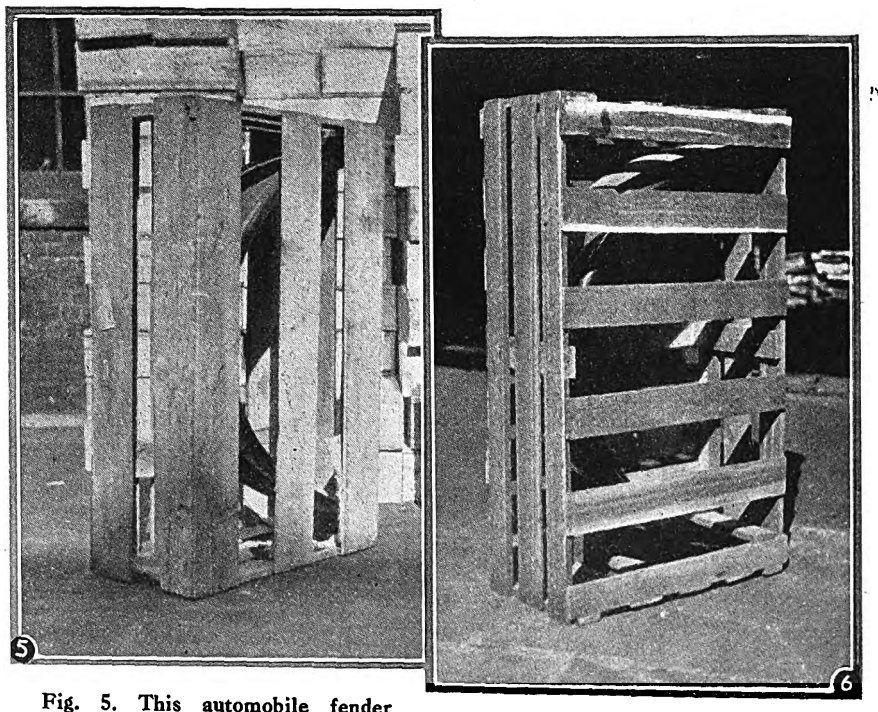


Fig. 5. This automobile fender weighs 16 pounds, and this crate, in which the manufacturer was shipping it, weighed 50 pounds. He had been using a heavy hardwood to make the crate.

Fig. 6. The picture may not show it, but this new crate, designed for the fender by the packing engineer, cut the shipping weight of the package from 66 to 30 pounds, a saving of 54 per cent. The new crate is saving $10,000 annually in freight and express bills.

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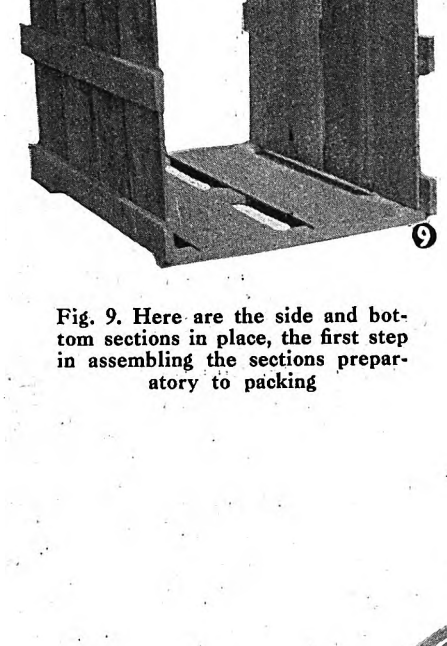


Fig. 9. Here are the side and bottom sections in place, the first step in assembling the sections preparatory to packing

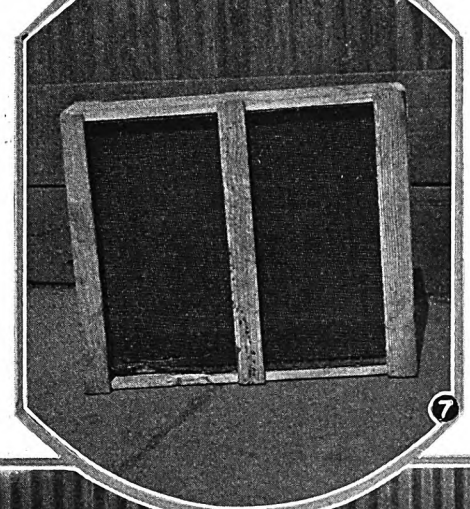


Fig. 7. One manufacturer, though shipping to manufacturers in quantity, was packing one radiator in a crate like this, and was having trouble with damaged shipments, as the picture will suggest.

Fig. 8. The engineer designed a crate for six radiators. At the same time, he worked out a plan to build it in sections, which saves much in labor. The picture shows the four sections completed.

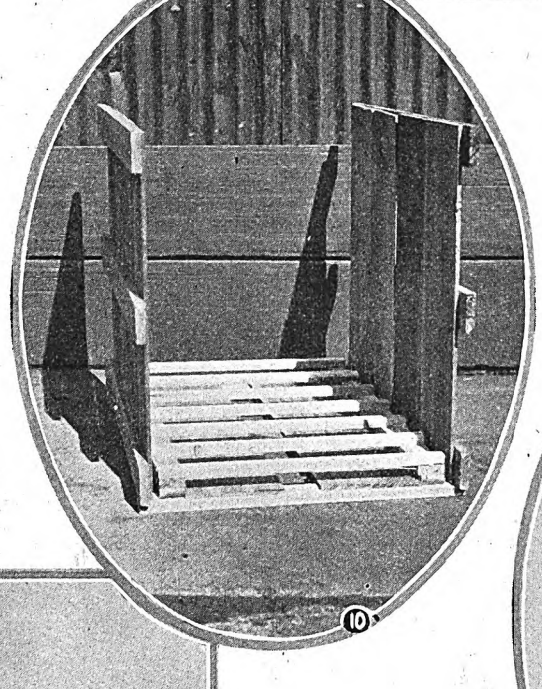


Fig. 10. To enable the crate to carry six radiators safely, the engineer designed a rack in which to nest them. The picture shows the bottom rack in place.

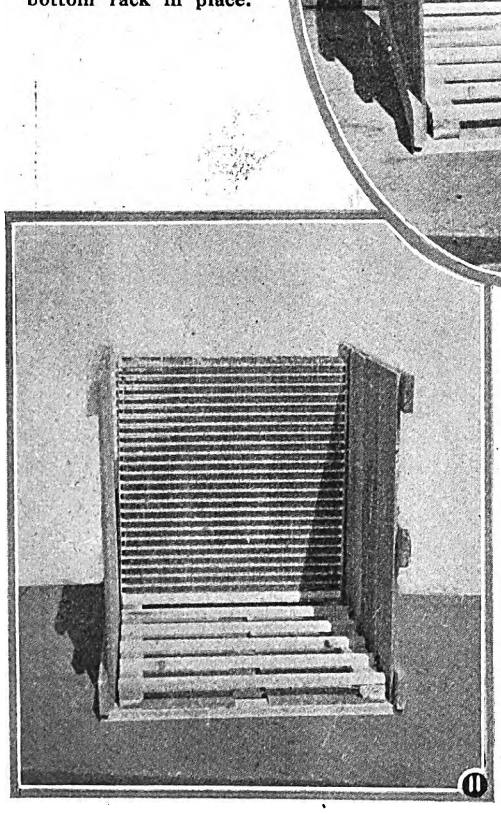


Fig. 11. This shows the first radiator in place under the new plan, the next step in packing.

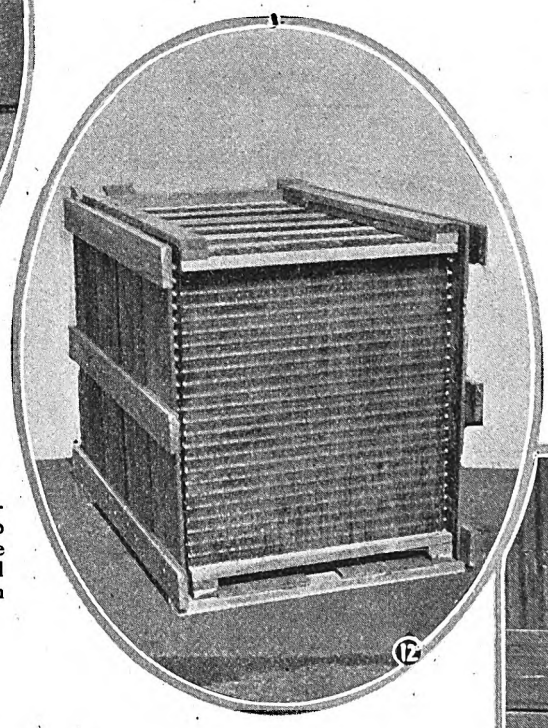


Fig. 12. With all the radiators in position, the top rack is put on. The racks, it can be seen, hold the radiators firmly in place.

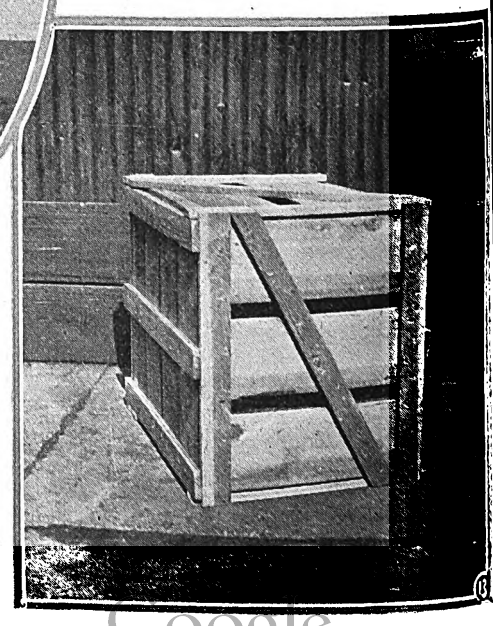


Fig. 13. The new crate designed by the engineer completely assembled. Compared with the old plan of crating the radiators singly, it saves 43 per cent. of the lumber needed and 57 per cent. of shipping weight per radiator, gives much better protection and saves in labor.

So common has been this tendency to use an excess of lumber to get strength that one of the engineers says "When I go into a plant, and they begin to tell me that they haven't any losses in goods damaged during shipment, I make up my mind right away that their packing is too good, that they have been using more lumber than necessary to get protection for their goods."

Of course, some shippers need to use more lumber to protect their goods adequately. The point is that, generally speaking, crating has not been made an exact science. Even some of the best shippers, who have been seeking most earnestly to protect their goods properly, have erred grievously by overdoing the job, failing to stop when they had enough lumber in their crates; and quite generally shippers have failed to appreciate all the various means of getting strength in crates without using more lumber.

Crating is a matter for the most searching investigation and study, but the average manufacturer hasn't given it this attention. The organization mentioned made a survey of crating practices of American shippers before launching its campaign, and found an almost total disregard of many of the more fundamental principles of correct crating as worked out by the U. S. Forest Products Laboratory and those manufacturers who had made a study of the question.

Strange and unreasonable things are being done in many big industries as a result of insufficient planning or study of crating. Certainly, with some investigation, the manufacturer who was using a 50-pound crate to ship a 16-pound automobile

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fender would not have made the error he did.

Nor would an Ohio manufacturer have made the mistake he did. This man bought and cut materials for a crate, at his plant in Ohio. The materials for the crate, and the product—an 18-foot section of rubber suction hose—then were shipped out to San Francisco, where after inspection the article was crated and sent on to China. The materials for the crating originally came from the West coast. So, in effect, this manufacturer was paying freight on them clear across the country twice, when they might just as well have been bought and cut in San Francisco.

Use of the three-way corner, diagonal bracing, proper blocking, correct nailing, selection of a lumber fitted to the job—these, and many other things, with which the crating engineer is familiar, enable him to build a much stronger crate with less lumber. Knowing definitely all the hazards of transportation and the value of the different ways of meeting them, he is able to reduce the planning of a crate to some degree of exactness. Moreover, each product presents an individual problem in crating, and, as shown by experience, may have peculiar and unsuspected possibilities for saving.

Application of engineering practice to crate making is bringing about almost incredible savings in some big industries. Selecting a lighter wood, the crating engineer reduced the weight of that crated automobile fender from 66 to 30 pounds, and as a consequence this manufacturer is saving $10,000 a year on freight and express bills alone. He had

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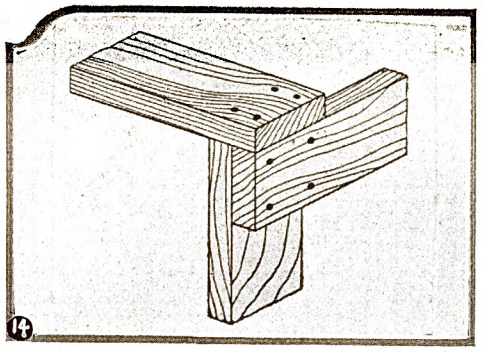


Fig. 14. The corner is the weakest part of the ordinary crate. The illustration shows a common method of crate corner construction where the lumber is not used to maximum advantage.

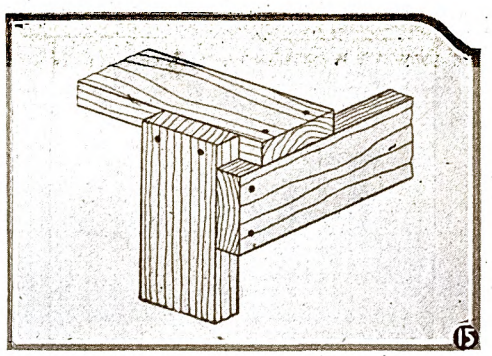
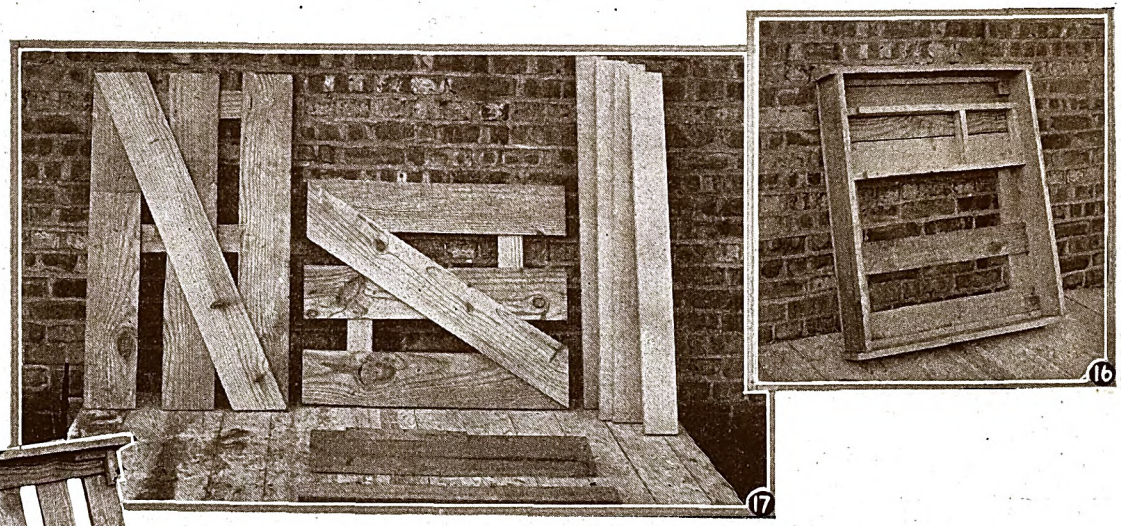


Fig. 15. One glance is enough to show the superiority of the three-way corner. Each member is nailed to another and has the third member nailed into it, and the nails are driven in the edge grain of the lumber.



Figs. 16, 17, 18. The packers in a washing machine factory had been cutting and fitting lumber for the crate in the shipping room. The crating engineer worked out a plan for building it that cut down the labor required one-half. The crates now come into the packing room in sections, and the packers simply put the sections together when machines are prepared for shipment.

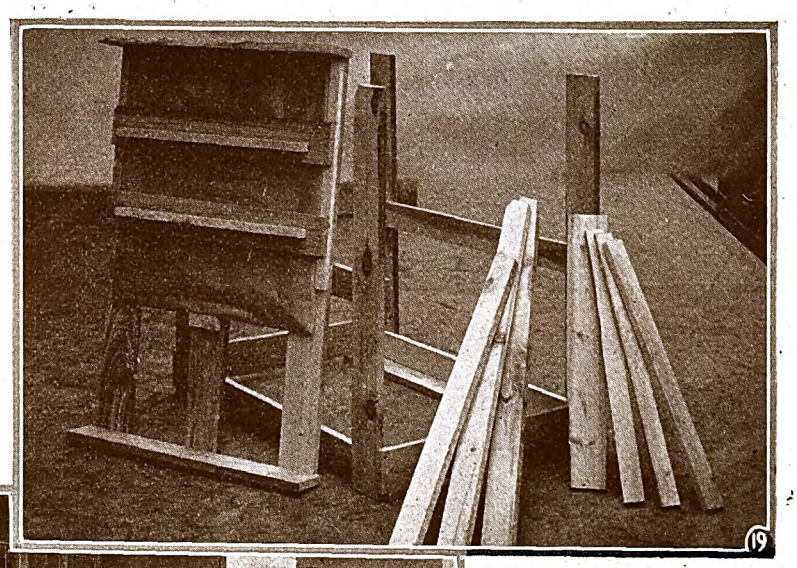
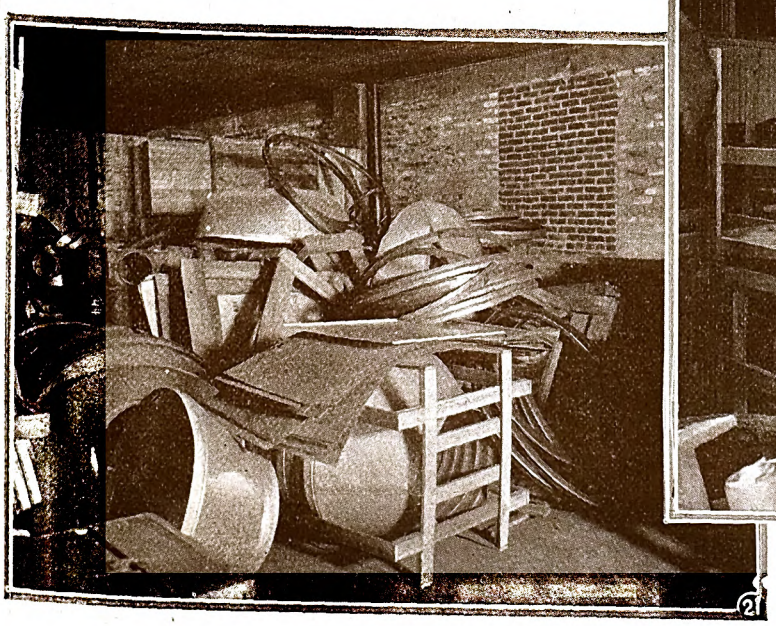


Fig. 19. These two pictures (19 and 20) illustrate the advantage of sectional construction in building crates. The picture at the right shows all the parts for the completed crate, partly assembled, so that with a minimum of labor the washing machine may be put in and sent on its way. This is a good illustration of how far the process may be carried.



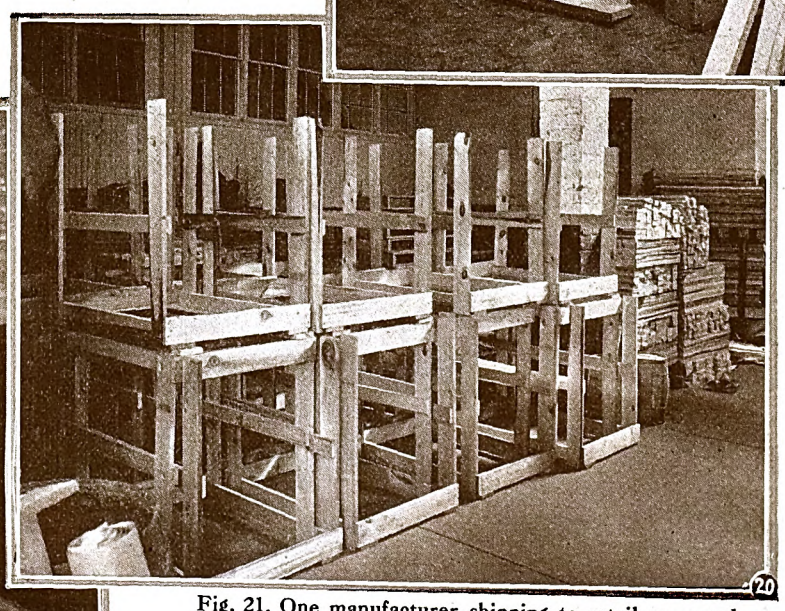


Fig. 20. Besides saving time in building, sectional construction has a big advantage in that workmen can make up parts in advance, when work is slack in packing or other lines. The picture at the left shows the partly assembled crates standing ready for the packer. Instead of building a crate as he needs it, the packer thus has at his elbow crates with nearly the whole job of building already done.

Fig. 21. One manufacturer, shipping to retailers, crated his furnaces together, putting the same parts in one crate. To assemble one, it was necessary to get a piece from ten or twelve crates. This retailer no longer handles this furnace!

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Systems and Application of Pneumatic Conveying

Handling Dry Bulk Material in Pipes

By Matthew W. Potts



Fig. 1. The domestic use of pneumatic conveying commonly called a vacuum cleaner.

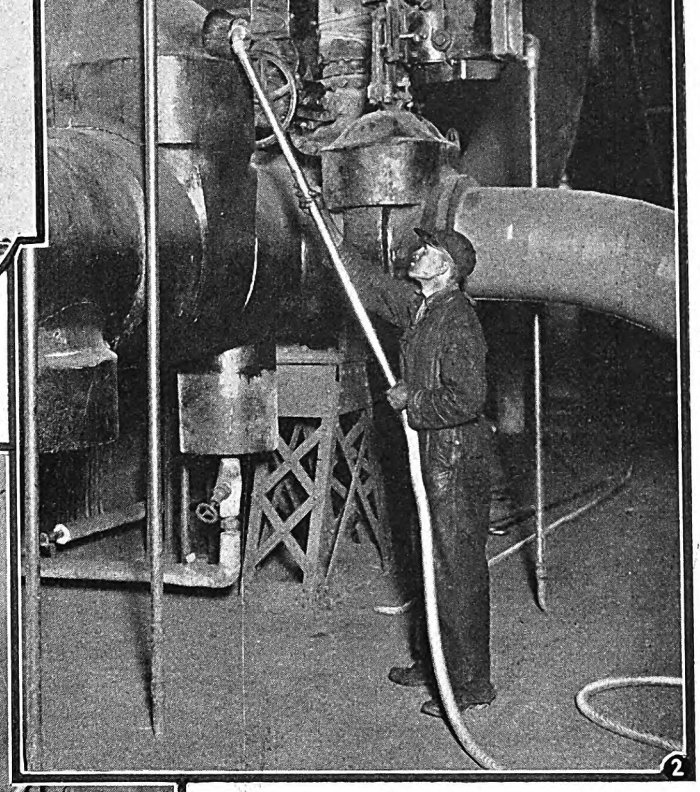


Fig. 2. Industrial cleaning is a long step from the domestic type shown in Fig. 1.

Fig. 3. Industrial cleaning systems are frequently conveying systems because of the volume of material handled.

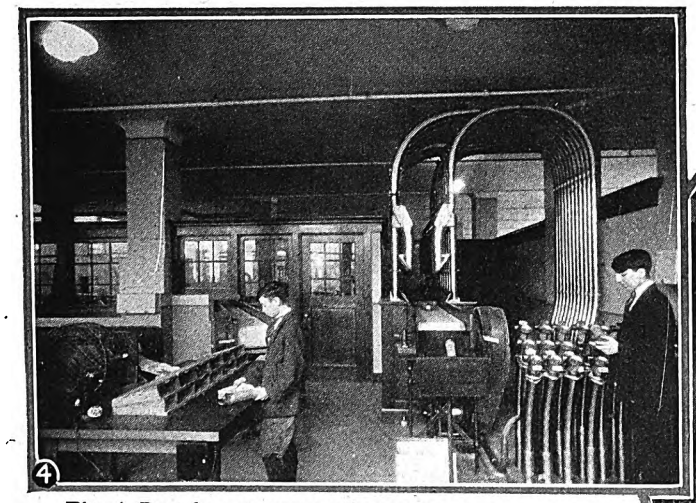


Fig. 4. Best known pneumatic conveyors are the types used in department stores.

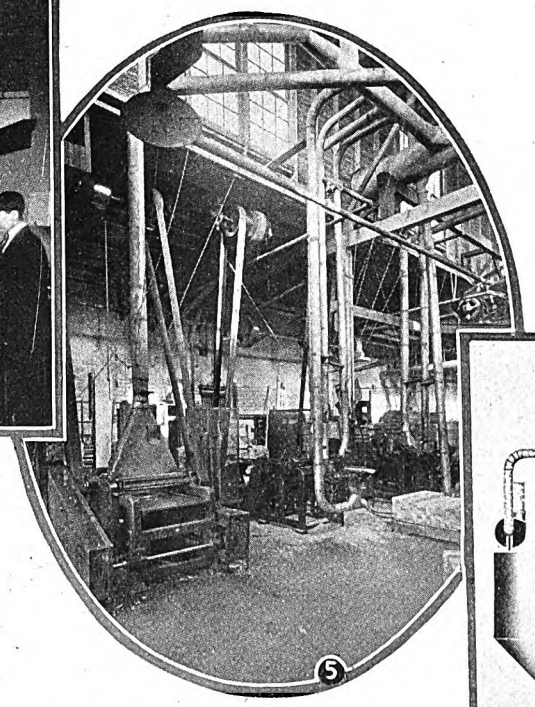


Fig. 5. Collecting of shavings, such as from wood-working machines, is a form of pneumatic conveying.

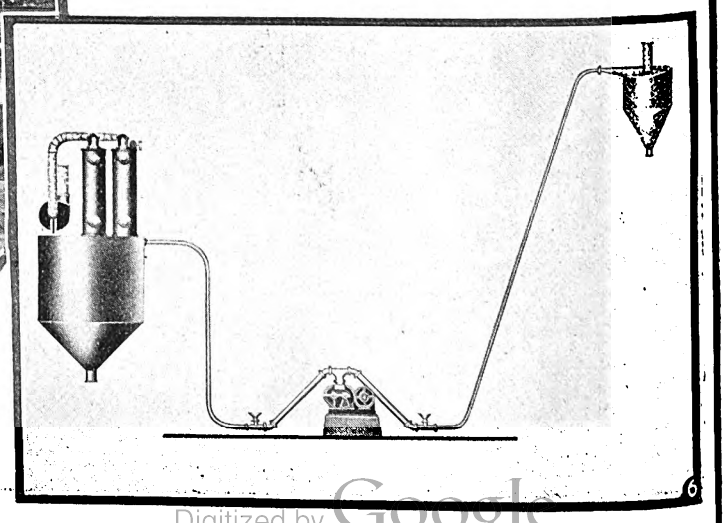


Fig. 6. Showing two diagrammatic layouts of bulk pneumatic conveying systems.

PNEUMATIC conveying has recently attracted great and widespread interest among engineers and others who are investigating the economical handling of materials. The information heretofore available on the subject has, however, been so meagre and so indefinite that it is felt advisable to present this concise outline of principles, methods and application.

The high cost of labor, coupled with the desire to improve the conditions of the worker who has to work in a dust-laden atmosphere of an objectionable or even poisonous nature, has created a demand for pneumatic conveying plants, and many new small and large installations are now being erected.

The principles of pneumatic conveying have been in use for a considerable time, although until recently only a few materials have been successfully handled. Engineering progress in the last few years, however, has increased the field of this method, and made it an important feature in the materials handling world. In this article, brief mention will be made of the various systems in use, and many examples will be given of installations in various fields, which have solved labor difficulties, cut costs, and improved conditions generally.

It was the need of water for human consumption and for irrigation purposes that caused the ancient inventors to carry

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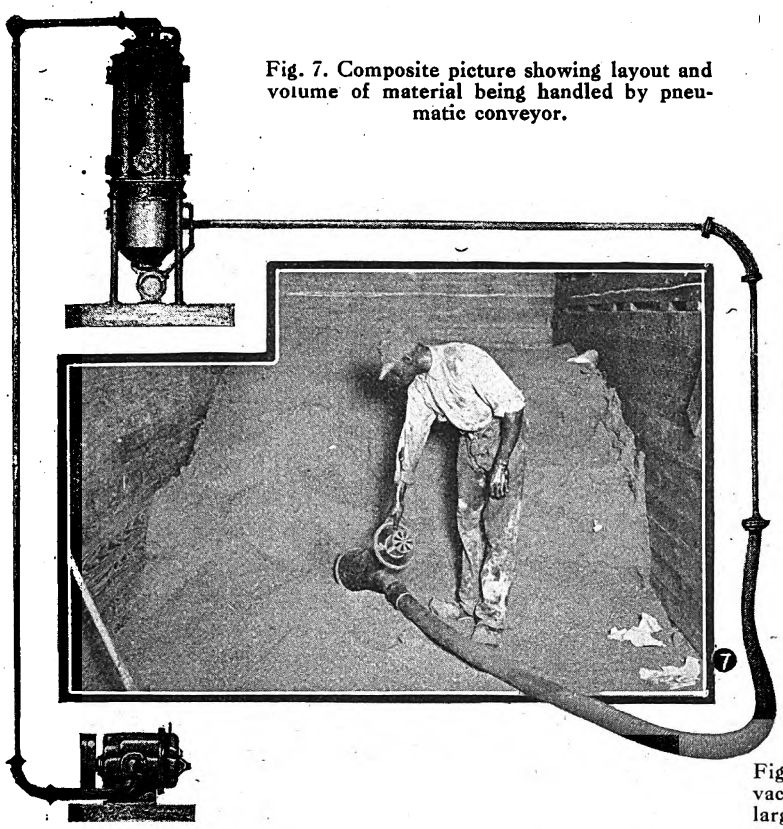


Fig. 7. Composite picture showing layout and volume of material being handled by pneumatic conveyor.

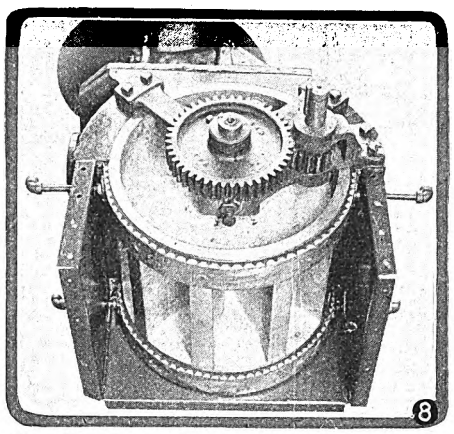
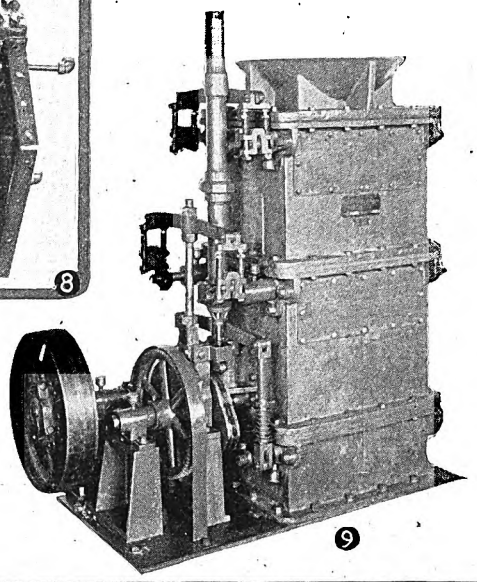


Fig. 8. This simple type of air lock was the limiting feature for many years to the broad application of bulk materials handling by the pneumatic principle.

Fig. 9. The new type multiple stage air lock has overcome the disadvantages of the simple air lock previously shown.



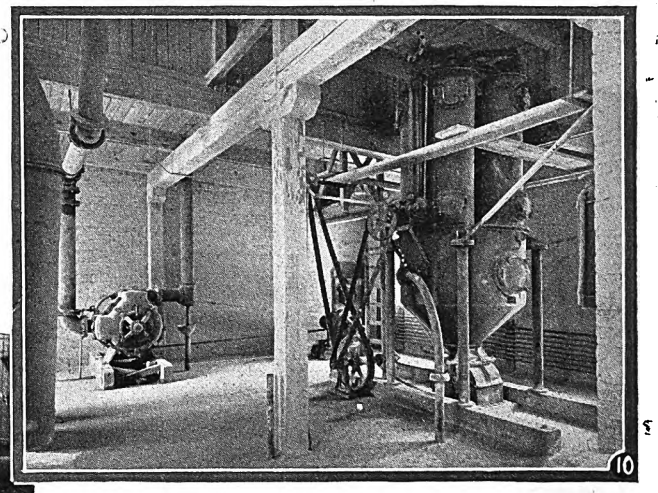


Fig. 11. Shop assembly of vacuum pump filters, etc., for large installation of pneumatic conveying of British manufacture.

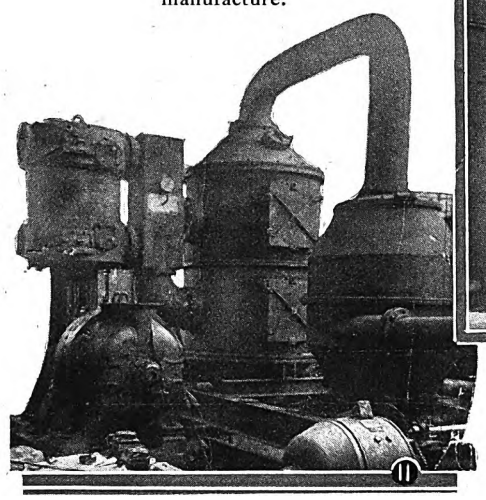


Fig. 10. Complete installation of vacuum pump filters and simple air lock by American manufacturers.

out nearly all of their experiments with that substance, and the first instance we have of anything approaching pneumatic conveying is the well-known injector, in which steam is passed through one pipe placed at right angles to a second pipe at such a pressure as to reduce the pressure in the second pipe to below the atmospheric pressure. The excess of atmospheric pressure over the reduced pressure in the second pipe then forces up the material (in this case water) into which the end of the pipe is submerged.

This invention is about a century old, if it emanated from the Marquis Mammonry d'Eclet, in 1818, as is usually believed. The first practical application of this invention to other than liquid materials was supposed to have been in connection with the conveying of cotton in loose form, as an improvement on the manual shifting of large bales. This development was made about 1867, and from this date gradual progress was made, principally in connection with the handling of grain, wheat malt, etc.

At present, it is hardly possible to enumerate all the successful schemes for the pneumatic handling of materials. In addition to the installation for the conveyance of materials such as those mentioned above, is the pneumatic tube for conveying papers, messages and cash in offices, and between shop counters and cash desks, etc., as shown in figure 4. This is really the best known pneumatic conveyor, and one that has had considerable development in this country. Also there is the suction cleaner, the domestic type of which is called vacuum cleaner, and which is shown in figure 1; and there is the industrial suction cleaner, ranging in application from the handling of refuse and dust from saw mills, wood working machinery, grain elevators, etc., to the removal of fine abrasive and poisonous particles in certain manufacturing processes. Illustrations are shown in figures 2 and 3.

Pneumatic systems for collecting shavings and transporting like materials in large pipe lines have been in use for many years. In these installations, large fans generate the air currents for conveying the materials. Figure 5 shows an installation of such equipment.

The sand blasting machine, used extensively in the larger cities for cleaning buildings of

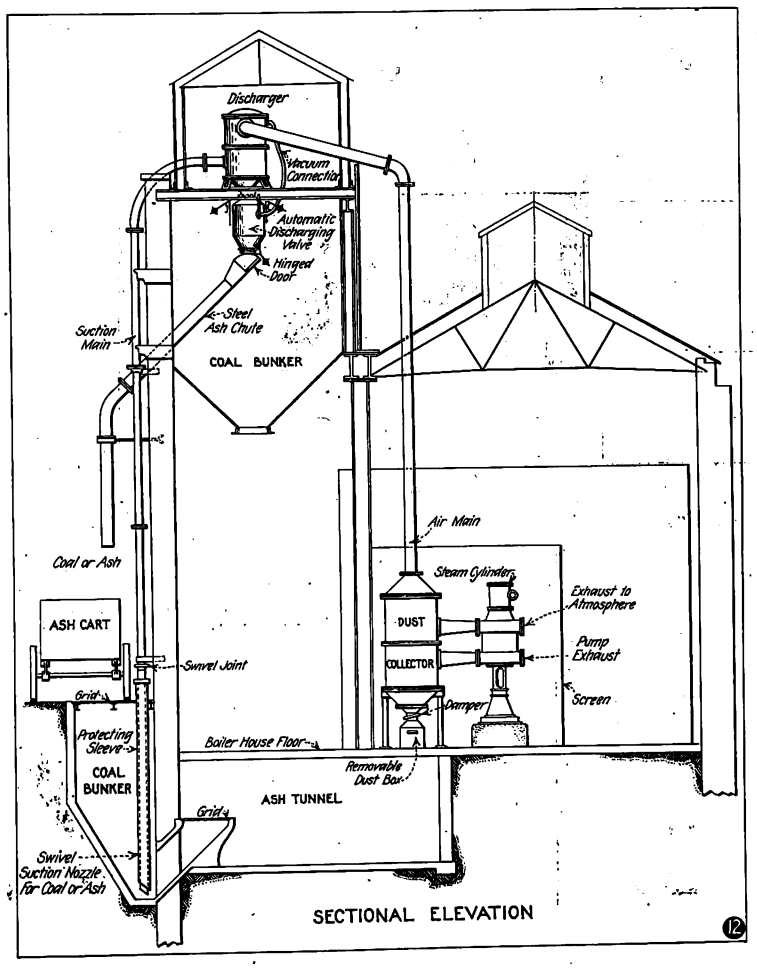


Fig. 12. Diagrammatic layout of coal and ash handling system for Messrs. Wardell & Davenport, Ltd., Leeds.

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the dirt which has accumulated on them since the use of soft coal became necessary, is really another example of a self-contained pneumatic conveyor on a small scale.

While steam is mentioned as the first medium for producing the air current, some materials cannot be handled unless they are carried in absolutely dry gas. In the strict sense of the term, pneumatic conveying really implies the conveyance of a quantity of material from one point to another, by means of air as a conveying agent.

It will be seen from the above that the subject embraces the removal of a comparatively light dust produced in many industrial processes, which is not considered ordinarily as pneumatic conveying, although the same name is applied to all types and installations. The methods to be adopted vary, and each case must be considered on its own merits.

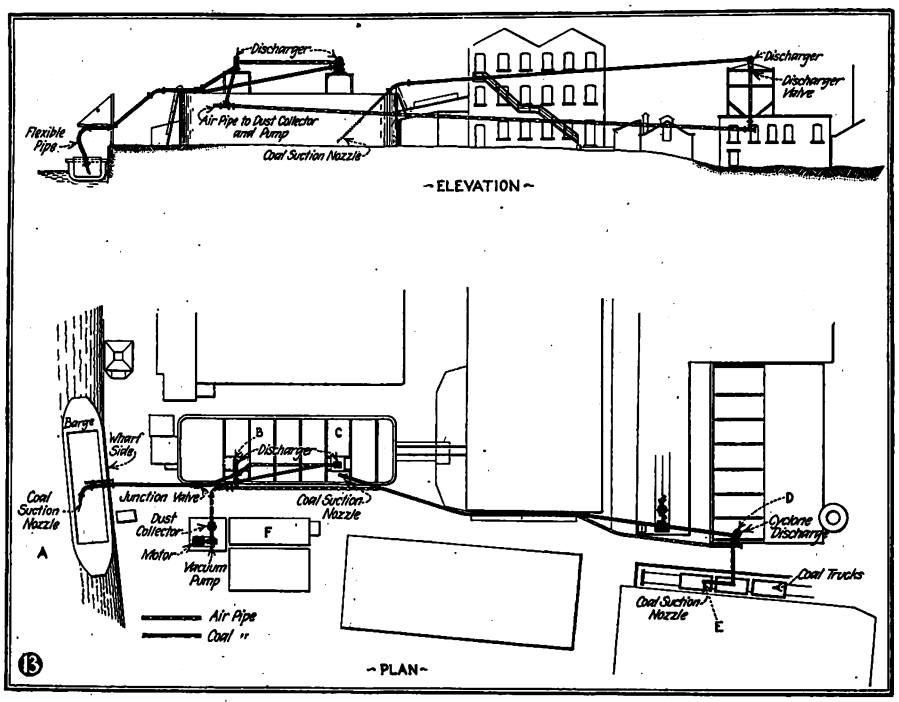


Fig. 13. Diagrammatic layout of pneumatic coal conveying plant of the India Rubber & Gutta Percha Co., Ltd., Silvertown, showing how coal can be unloaded from barge or coal lorries for delivery to boiler house.

It is regrettable that in some cases ordinary vacuum cleaning machines, such as shown in figure 1, and slightly larger units, have been sold to manufacturing establishments upon the representation that they are suitable for the collection of dust and fine materials. These operate successfully if the dust and sweepings are not of large volume, but the ordinary small vacuum cleaner as used in homes, hotels and office buildings, is not of sufficient capacity for the majority of installations in industrial establishments. Naturally the results have been somewhat unfavorable and caused prejudice against this method of dust removal, which is most unfortunate, because a system properly designed and of sufficient capacity would have solved the problem.

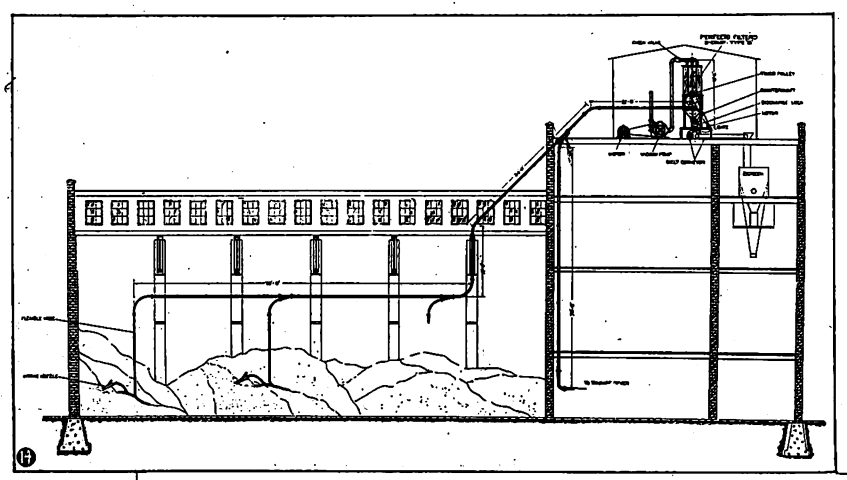


Fig. 14. Diagrammatic layout of pneumatic conveying system in large packing house, dry bone and bone dust storage. Installation of pneumatic conveyors saved the wages of twenty men.

In the boiler room of the immense Central Station (Colfax), a pneumatic sweeping system is used to keep the boiler room in a clean and inviting condition. All the coal siftings and the dirt and dust accumulations on the boiler tops, boiler exteriors, piping and structure, are picked up and lifted to an overhead collector from which this combustible material is delivered into the stoker hoppers. Figure 2 shows the method of sweeping off the pipes, etc., while figure 3 shows the large quantity of coal siftings which are being picked up by this pneumatic sweeping system.

A pneumatic conveying plant of practically any type, com-

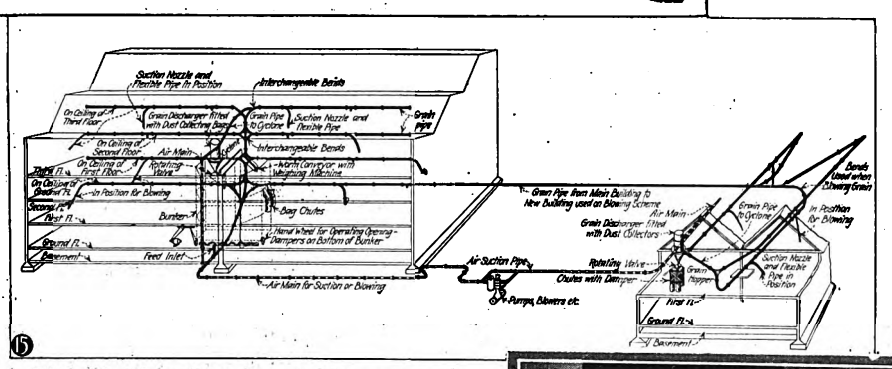


Fig. 15. Complicated and elaborate pneumatic conveying installation for handling dry brewer's grains which are used as cattle feed.



Fig. 16. Close-up view of pneumatic conveyor nozzle, taken inside arsenic settling chamber, and showing method of loading conveyor.

Fig. 17. View showing pneumatic conveying pipe with Y connections for flexible hose, which are placed in arsenic settling chambers for handling materials.

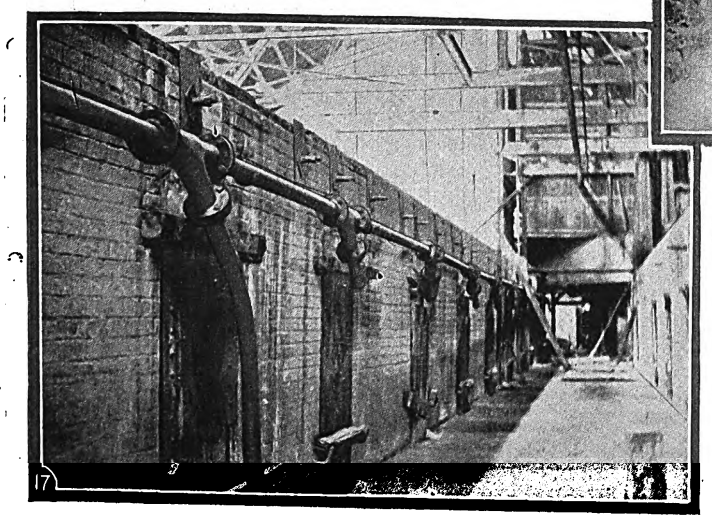
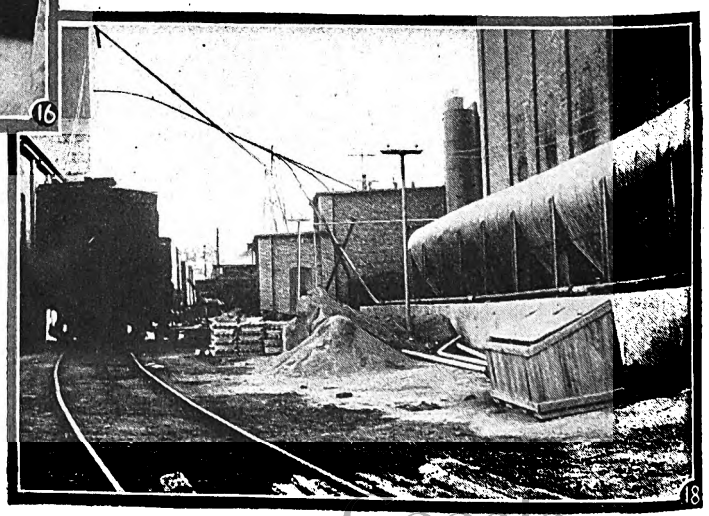


Fig 18. Simplicity of installation is one of the main points in favor of pneumatic conveying. The pipe and flexible hose shown is the pneumatic conveyor, and the material intake is at the base of the hopper. The material being handled is blue fume in lead smelter.



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prised the following five main components:

First: a vacuum pump or exhauster to create a partial vacuum in the pipe line and so induce a high velocity air current in which the material will be conveyed.

Second: An air filter in which any light dust carried beyond the discharger is trapped to prevent its entering the exhauster, where it would quickly damage the piston rings and cylinder walls of a reciprocating pump.

Third: Main receiver or discharger, and occasionally one or more subsidiary receivers, in which the conveyed material is extracted from the system and discharged into a receptacle or on to a dump, conveyor, etc., as required.

Fourth: The pipe line junctions, etc., to connect the point of supply with the point of delivery.

Fifth: Suction nozzle, through which the materials enter the system together with the free air which is to act as the conveying medium.

With regard to the installation of a conveying plant proper, points for consideration in the initial stages are as follows:

1. The nature of the materials to be handled and the quantity required in a given time.
2. The size of the largest and smallest piece of material and the density.
3. Percentage of moisture. (Materials should be dry or nearly so.)

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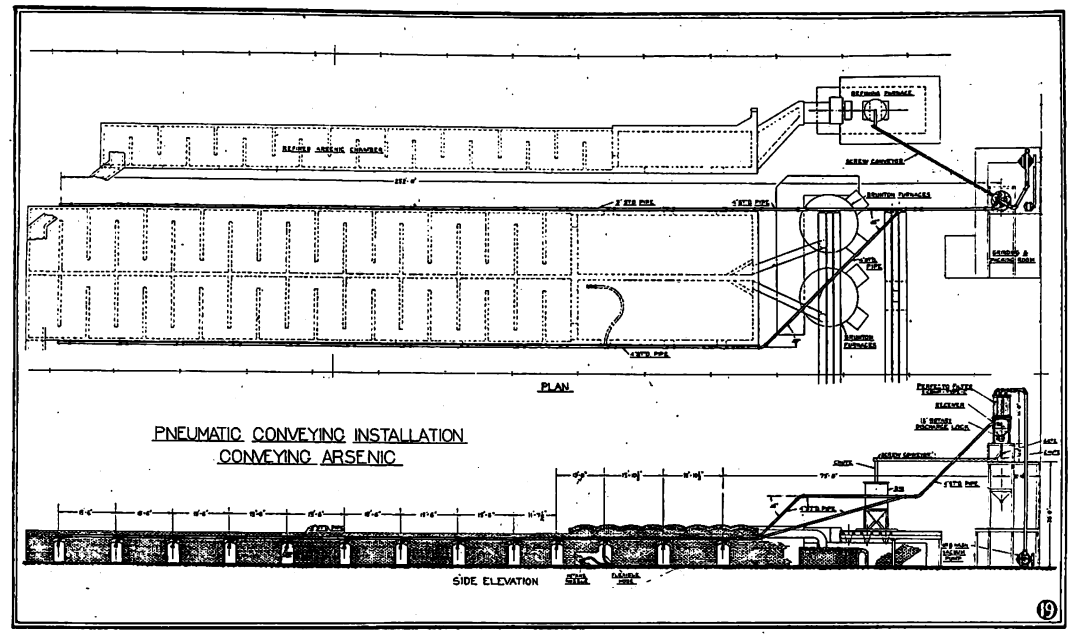


Fig. 19. Plant elevation and sectional views of pneumatic conveyor for handling arsenic from settling chambers. This is the same installation as shown in photographic views 15 and 16.

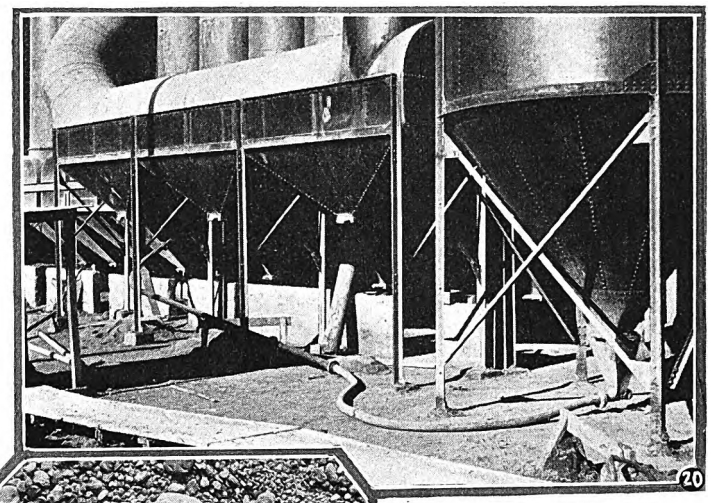


Fig. 20. Continuation of installation shown in figure 18, showing method of transporting blue fume over railway tracks, buildings, etc., to bin storage for car loading.



Fig. 21. Pneumatic conveying is not limited to fine or soft materials. Here is shown phosphate rock (one-third size) which is now being successfully conveyed.

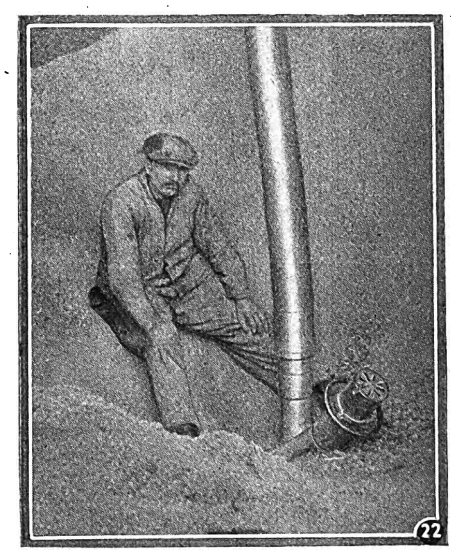


Fig. 22. View in hold of ship with unloading well advanced, showing nozzle and pipe line handling phosphate rock as shown in figure 21.

Fig. 24. Shows conditions under which operation was being made in figures 20-21. The cold, ice and sleet, also rain, would have given considerable trouble to other mechanical unloading devices.

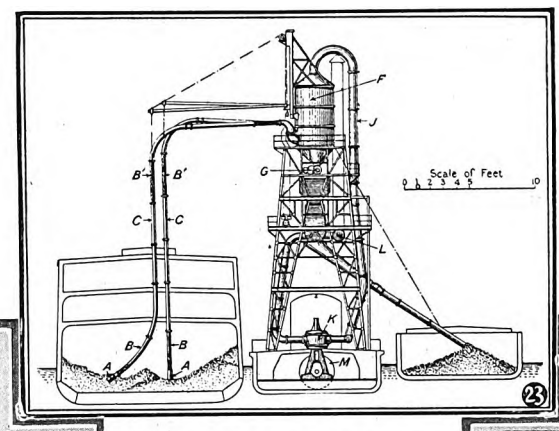
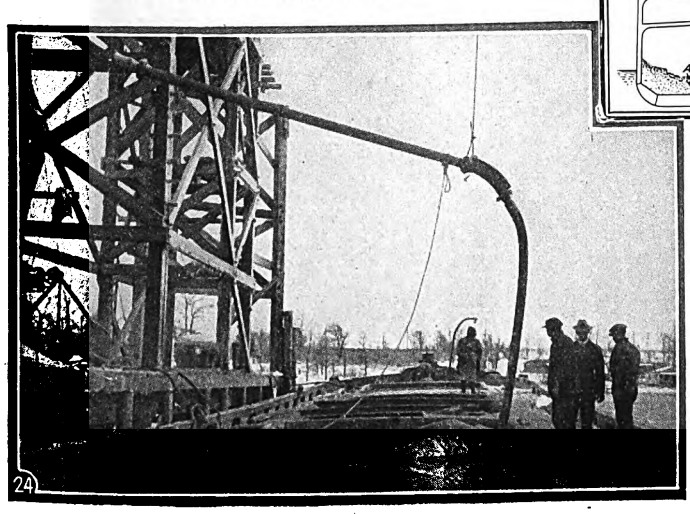
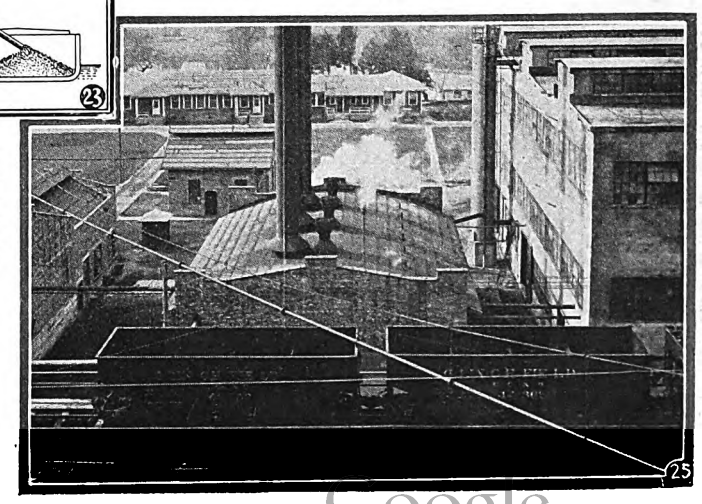


Fig. 23. Floating pneumatic transfer plants have not appeared in this country, but are successfully operating in England. The one shown above can handle from 200 to 250 tons of grain per hour.

Fig. 25. Pneumatic conveyors can be suspended from building to building by cable as shown, thus eliminating expensive bridges and superstructures when installation is desired.





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Fighting Friction in the

How Lubrication Science

BY ALLEN F

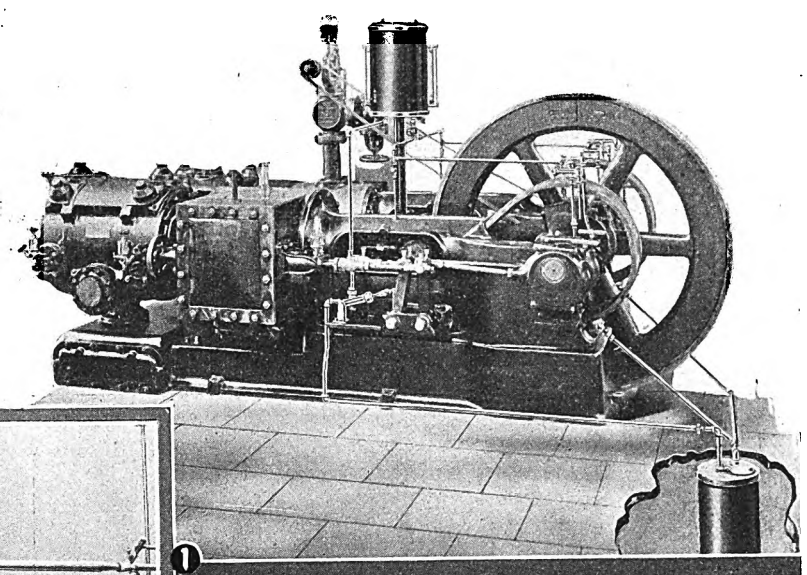


Fig. 1. Individual oiling and filtering system on an air compressor installation. Oil piping can be clearly followed.

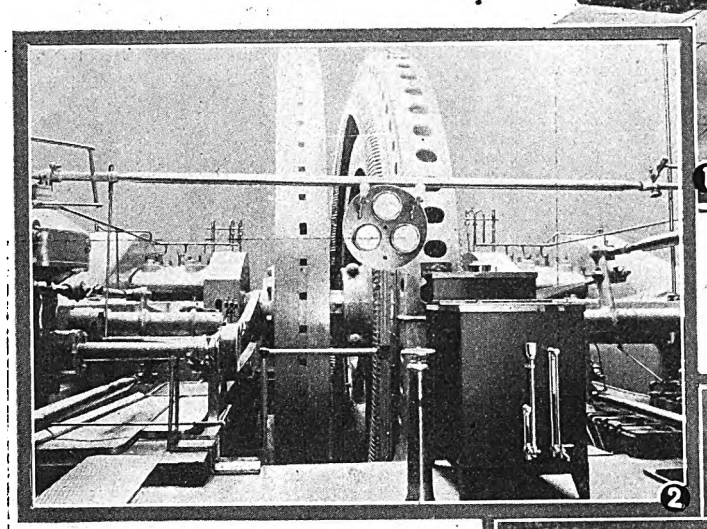


Fig. 2. Cross Compound Corliss engine equipped with an individual oiling and filtering system. Oil piping details and filter are in clear evidence.

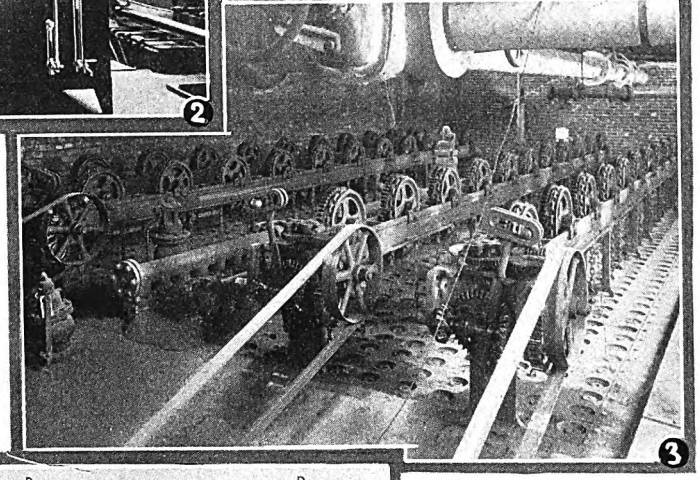


Fig. 3. Details of scraper driving and reversing mechanisms on a modern economizer installation. Considerable heat is often present in such locations and careful attention to lubrication is necessary.

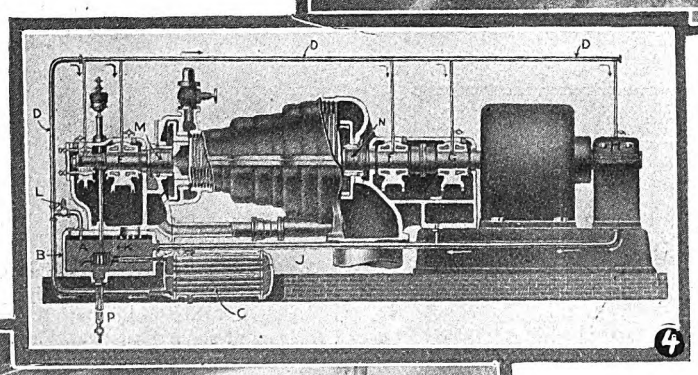


Fig. 4. A self-contained oil circulating system on a steam turbine. Legend: B, Oil reservoir; C, Oil cooler; A, Turbine oil pump; D, Main oil line; E, F, G, and H are bearings; J, Return oil line, etc.

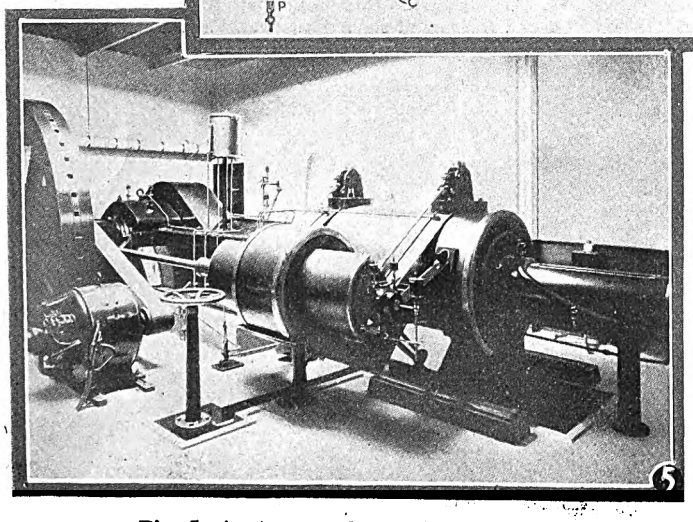


Fig. 5. A poppet valve engine equipped with an individual oiling and filtering system.

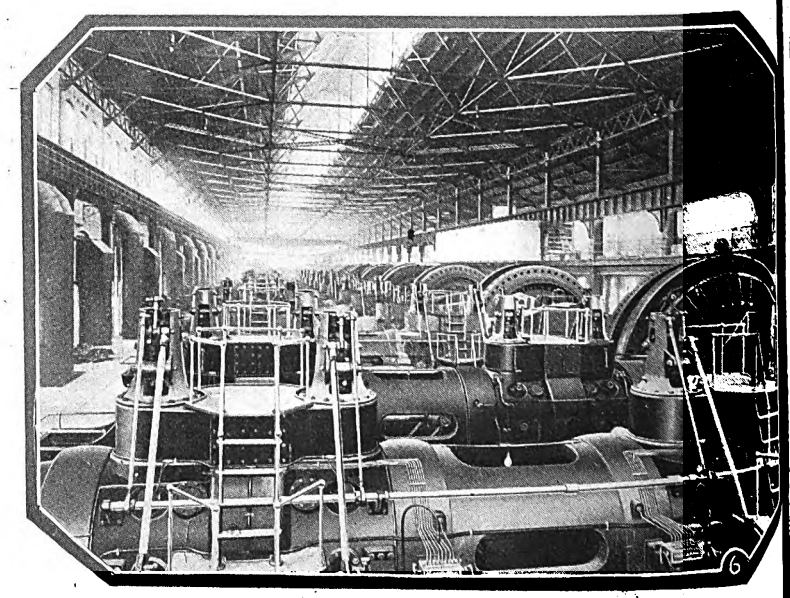


Fig. 6. Gas engines equipped with gas engine lubricators. There are a total of over 1,800 feeds in this installation.

TO a layman, perhaps one of the most impressive experiences is to make a tour of inspection of a modern power plant. To listen to the rhythmic drone of a huge turbo-generator, or to watch a modern Corliss or Uniflow engine in operation is apparently an awe-inspiring attraction to us all. But as often as not we will, on turning away, remark upon the wonders of electricity or the marvelous power of steam, and lose sight completely of a factor without which neither our steam or electricity could function. In other words, steam, electricity or water power is ineffectual without lubrication.

Whatever the type of machine, its motive power or principles of operation, somewhere there are certain bearing surfaces in more or less close contact wherein friction is a vital factor. Under modern high speed conditions this frictional resistance must be overcome. It used to be possible to operate certain of such machinery at relatively low speeds, and with comparatively high clearances between bearing surfaces. As a result, while friction imposed a heavy load upon the machine and bearings naturally overheated, yet temperatures did not tend to rise to a dangerous extent. Perhaps lubrication would be applied to such bearings, per-

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Modern Power Plant

Helps to Cut Power Costs

BREWER

haps not. It all depended upon the installation and the ability and judgment of the engineer. At all events, any lubricant that was used frequently happened to be a relatively crude product, and many times entirely unsuited to operating conditions. We have but to look back to the "old tallow pot" which perhaps our uncle kept simmering on the steam-chest of his saw mill engine, etc., to appreciate all this; or to review the many times some of us have soused a line shaft bearing with a shot of waste oil.

Tallow and lard are excellent lubricants, but science and research have proven that they are most effective when in compound with mineral oils. So it has also come about that science and research have proven that lubrication is relatively the keynote of modern power plant efficiency. The high speed turbine and the multiple expansion condensing steam engine, oftentimes operating on superheated steam, soon proved to us that no longer could we shoot a dose of tallow into steam cylinders, or increase clearances or perhaps squirt an extra allotment of oil into bearings now and then. Scored cylinders, compression losses, and burned-out bearings made it essential that all such

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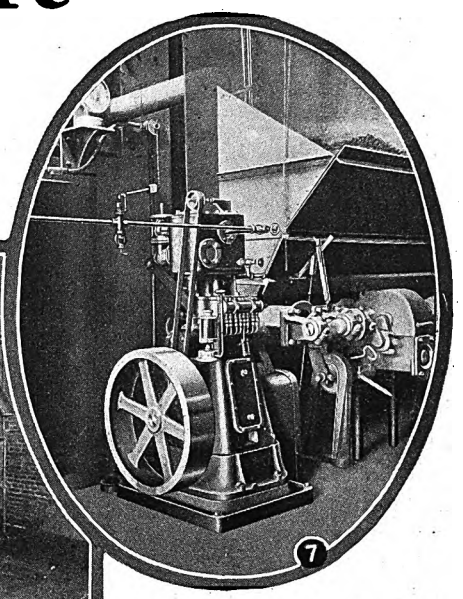


Fig. 7. Stoker engine of the vertical single cylinder type equipped for forced feed lubrication.

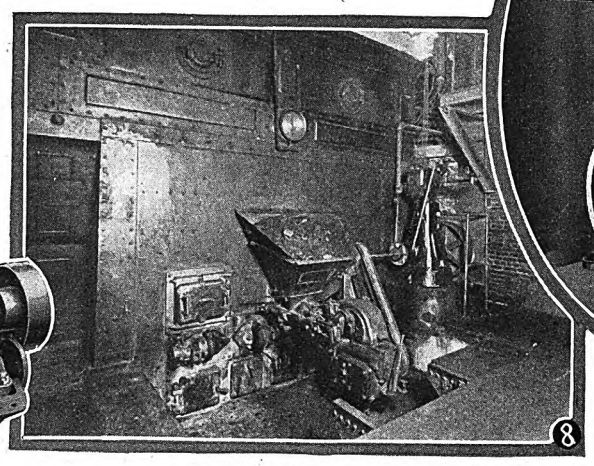


Fig. 8. Typical stoker installation as applied to a low set boiler. Note driving engine and chain transmission, etc.

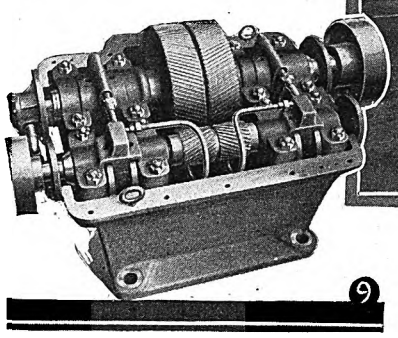


Fig. 9. Herringbone gear transmission for connection between a slow speed generator, fan or pump, and a high speed turbine. Forced lubrication is a feature.

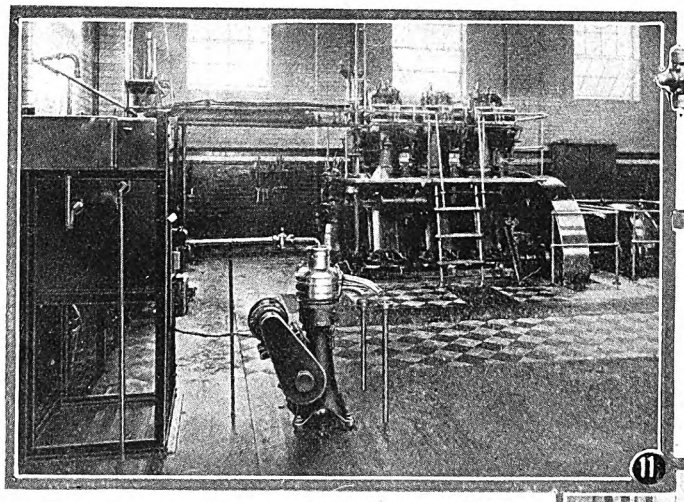


Fig. 11. A British Diesel engine installation, showing certain of the lubricating piping and the oil purifier attached.

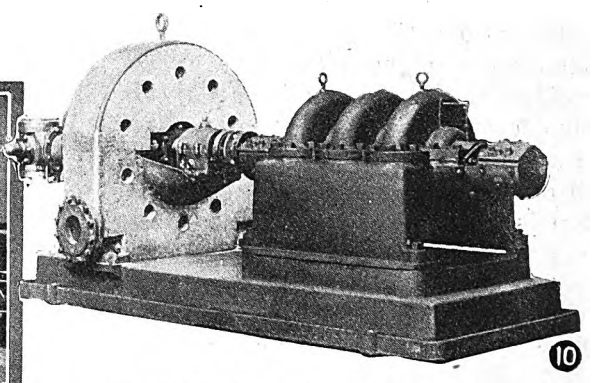


Fig. 10. Turbine driven, three stage centrifugal pump. Bearing lubrication is decidedly important on such an installation.

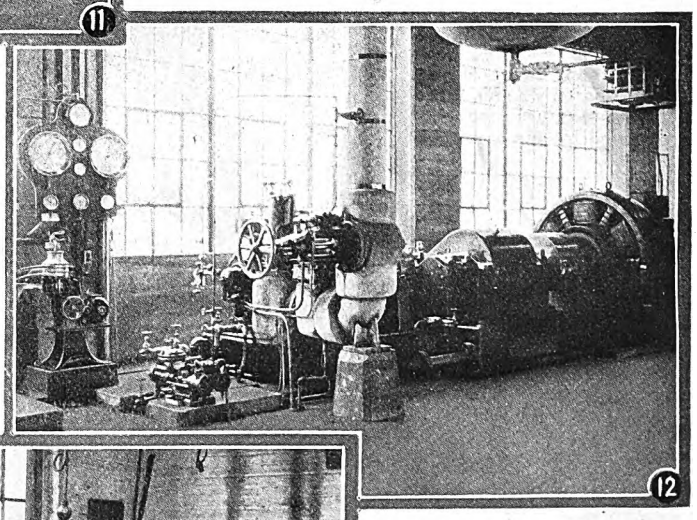


Fig. 12. Especially in turbine work is purification of the lubricating oil an important factor. Both lubricating equipment and purifier are here shown.

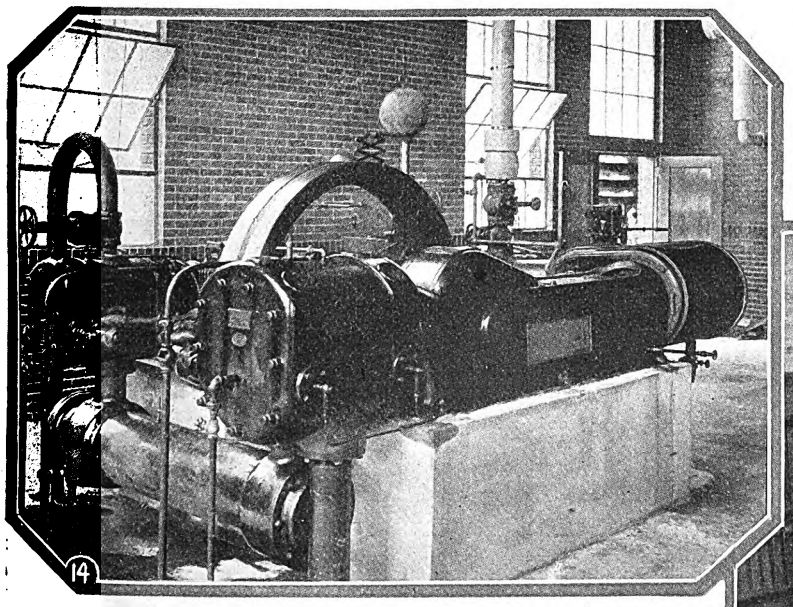


Fig. 14. In two stage compressors and other multiple types forced feed lubrication of both steam cylinders and air cylinders is the most positive. Other bearings are often lubricated by some form of splash or forced feed lubrication.

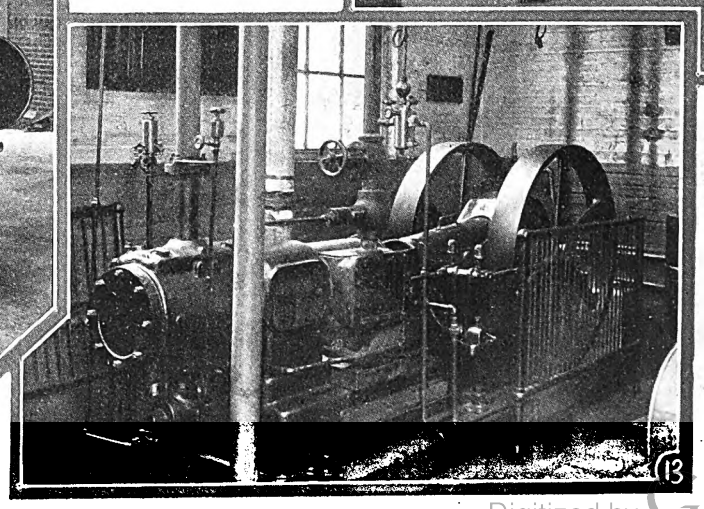


Fig. 13. The hydrostatic lubricator for steam cylinder service, and the sight feed oiler are often applicable to single stage air compressors.

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Making Labor Appreciate the Labor-Saving Idea

By E. T. Bennington

Manager, Cleveland Electric Tramrail Division, The Cleveland Crane & Engineering Co.

THE action of the present Administration at Washington in limiting the immigration of labor is beginning to be felt by all industries.

This has brought about an unusual demand for labor saving and materials handling machinery which is likely to continue for some time to come. Industries that formerly were very wasteful in their use of labor have been forced by necessity to devise ways and means of overcoming their problems of production and handling in a more efficient manner.

The application of materials handling machinery presents a problem which is given too little consideration by the operators of some plants. In order to get all out of a labor saving device that is built into it, it is necessary to have the employees who operate these machines, in a frame of mind that will permit their doing the best they can to see that the equipment performs the functions for which it is designed. It is impossible to get the employees in a frame of mind to welcome labor saving devices unless an effort is made to show them that their own best interests are promoted through the use of such equipment.

The substitution of machinery for manual labor has been increasing continually for the past several years and is likely to continue to increase for some time to come and to replace many forms of common labor in the performance of tasks which should have been handled by machinery long ago. The increase in the use of labor saving and materials handling machinery, especially as applied to industrial plants, is not looked upon with favor by some labor organizations and in a great many instances is met with resistance on the part of laboring men. This resistance is undoubtedly prompted by a desire to promote the best interests of the laboring man.

An investigation of the subject will disclose that the interests of the laboring man are promoted rather than retarded by the use of labor saving machinery.

The process of evolution is bound to take this course. It is only a matter of time until all of the disagreeable, heavy and

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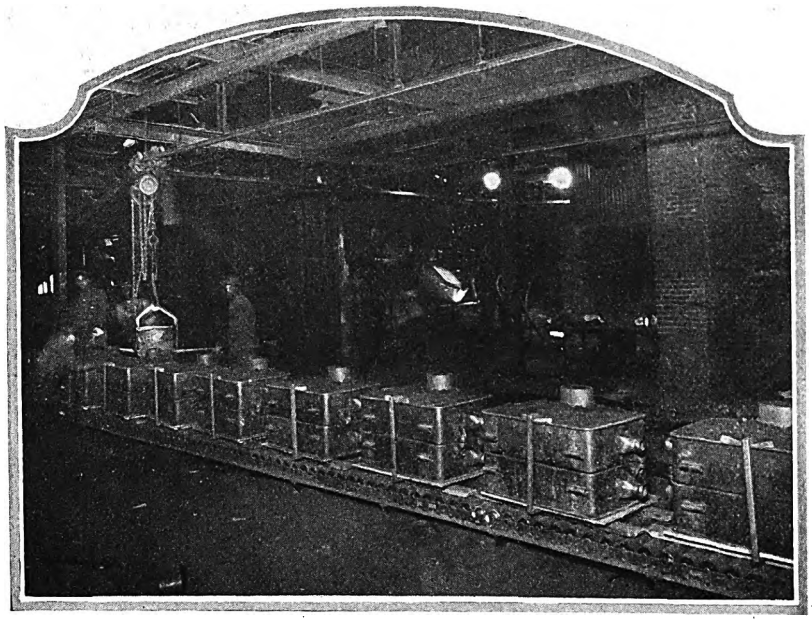


Fig. 1. Pouring molds in the foundry, with the help of an overhead rail and hoist.

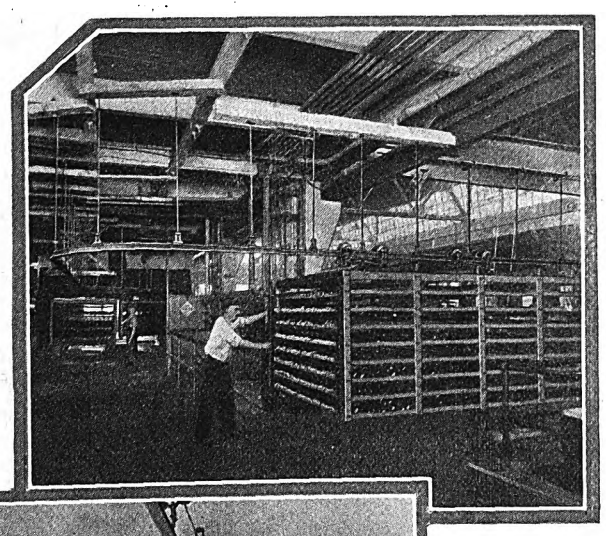


Fig. 2. These cages of japanned parts, weighing up to two tons, are readily handled by one man.

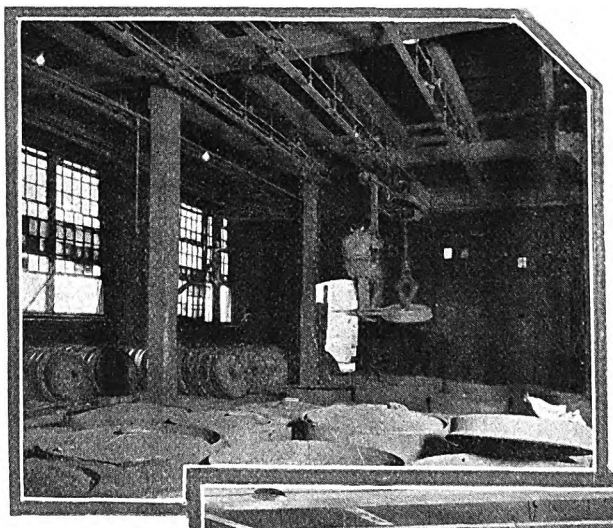


Fig. 3. This motor-operated hoist, which is in almost continuous operation through the working day, has the operator's platform equipped with a seat.

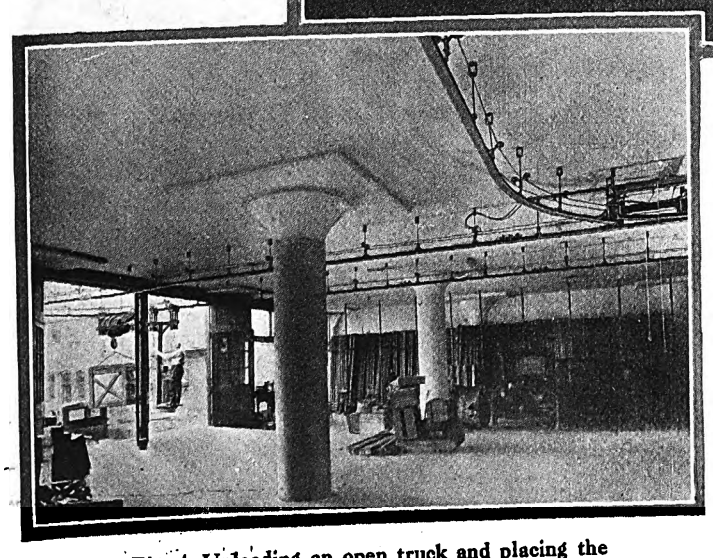
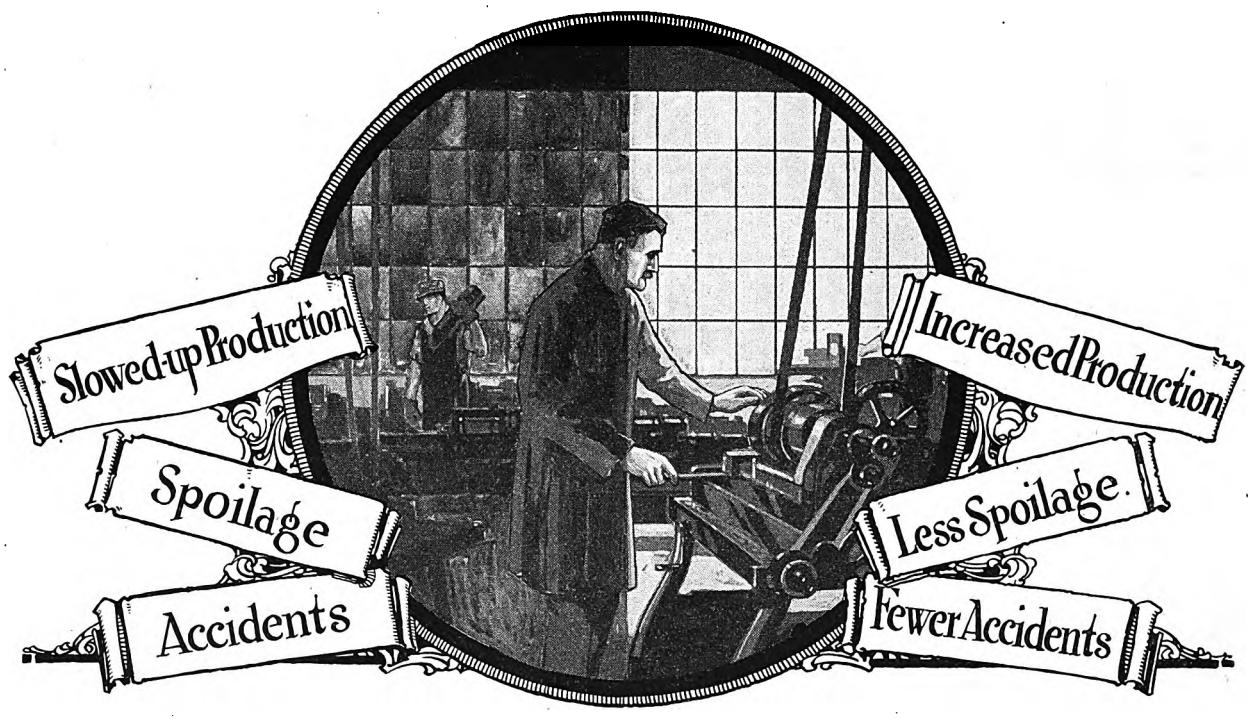


Fig. 4. Unloading an open truck and placing the material where wanted without rehandling.



Fig. 5. A large warehouse in Illinois, where materials handling equipment means dollars and cents, plus better labor conditions.

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Which half of the circle pictures your plant?

Of what value is white painted interiors if dirty glass bars out the daylight?

WHY paint the interior of your plant to reflect the light and then allow dirty, soot encrusted skylights and windows to bar out the light?

Perhaps you do not realize how easy it is to clean this rust and carbon scale covered glass. Then read how hundreds of great foundries, steel mills and manufacturing plants clean their glass quickly—easily—at the trifling cost of less than 3/4 cent per square foot with—

REG U.S. Pat. Off.

Skybryte CLEANER (LIQUID)

$7,000 YEARLY SAVING

for Joseph T. Ryerson & Son, Inc. with Skybryte

—

A recent survey in the Ryerson Jersey City warehouse showed Skybryte saves over $7,000.00 *yearly in increased production and decreased illumination cost. We shall gladly send you a copy of this complete survey on request.*

EASY TO USE

Any unskilled laborer can accomplish miracles with Skybryte. He simply coats Skybryte on the dirty glass. Almost instantly the most stubborn crust of rust, grease or carbon scale is dissolved. Then he flushes off with water and the glass is clean. In pours the welcome daylight. Up jumps production. Spoilage is lessened. Accidents minimized. The workmen's morale much bettered.

HARMS ONLY DIRT

Unlike strong chemicals Skybryte does not harm putty, paint or sash. We guarantee this. And well known institutions who have bought as high as 50 barrels of Skybryte will gladly tell you that this is absolutely so.

AND VERY ECONOMICAL

You might expect such an amazingly effective product to be extremely costly. On the contrary Skybryte is very economical. Five gallons cleans 4,000 square feet per day. The average total cost of cleaning including both labor and Skybryte is less than ¾c per square foot.

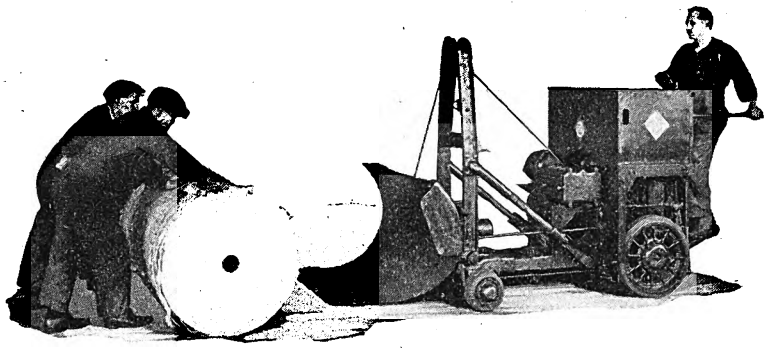
TRY SKYBRYTE AT OUR RISK

Let us prove to you entirely at our own risk that Skybryte will accomplish amazing results for you too. Just write for details of our trial order.

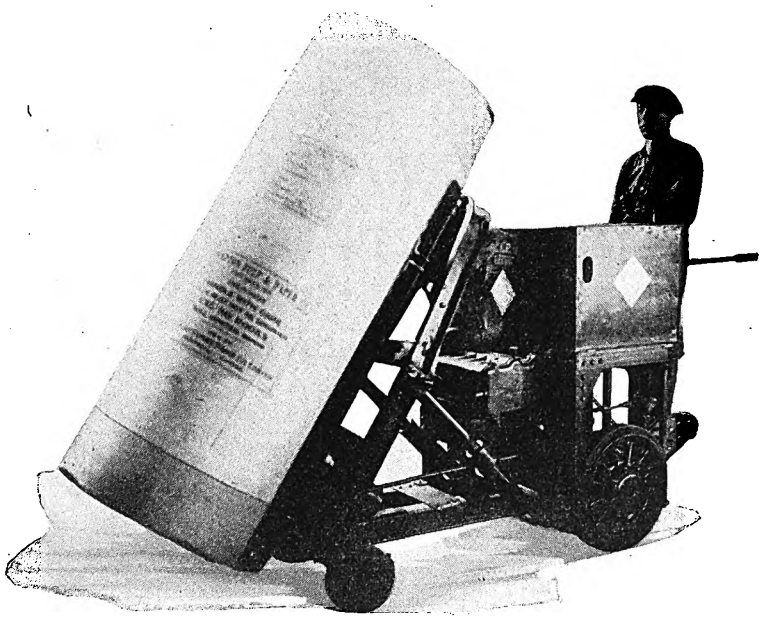
THE SKYBRYTE CO., KEITH BUILDING, CLEVELAND, OHIO
Chicago Branch, 20 East Jackson Boulevard

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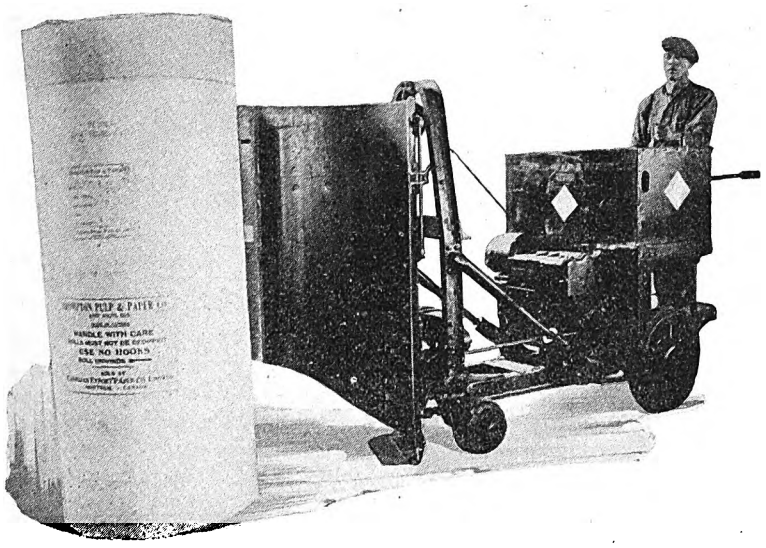
A Good Helper Always on the Job



It Picks up



and Carries



and Puts Down!

YOU'RE bound to be impressed, as you follow an Elwell-Parker Tructor for a little while as it goes about its regular round of "chores," with the fairly human way it does its work.

Vastly more economical and reliable than any like amount of man-power could be—but still a complete, well-rounded worker by itself—the Elwell-Parker Tructor goes to its load, picks it up, makes the trip with it, and sets it down again.

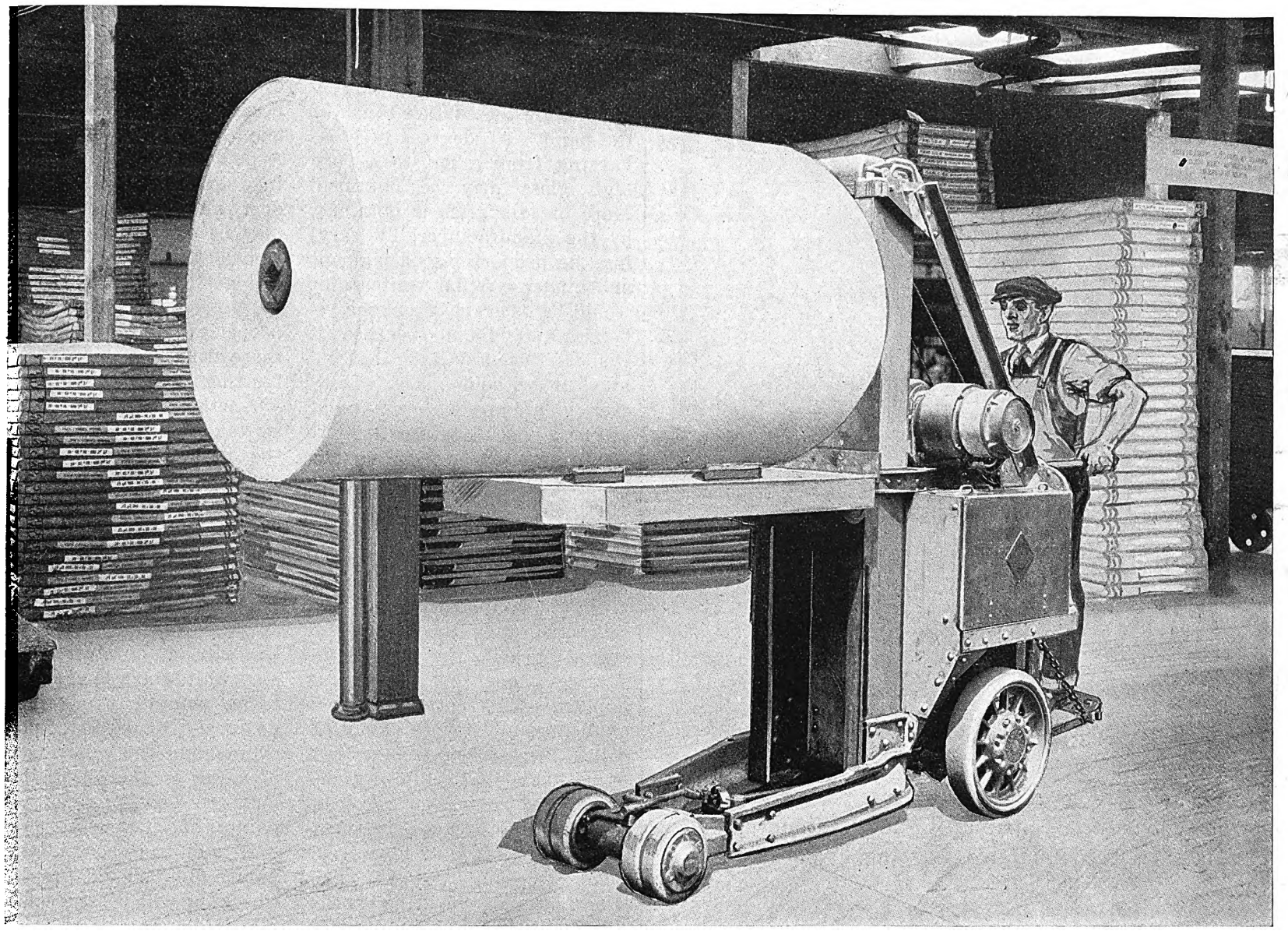
Just as easy as that—nearly as quick—with a minimum of manual labor—and at a big saving on every ton it handles!

The Elwell-Parker Tructor shown here is handling rolls of news-print, but its field is practically unlimited. Elwell-Parker furnishes only equipment suited to the industry served.

Write, telling us what *you* want to handle by tructor, giving any particulars, and we will send you an interesting report, with real figures covering the performance of Elwell-Parker Tructors in your own and related industries.

Elwell-Parker

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And now—the Elwell-Parker

HI LO

JUST as husky and dependable as it *looks*, and just as good a performer as its name suggests—the Elwell-Parker "Hi-Lo" Tructor brings its owners all the strength, and reliability, and dependable operation that Elwell-Parker owners always expect—and get—

Plus a platform lifting range of 6 feet with a 3-ton load!

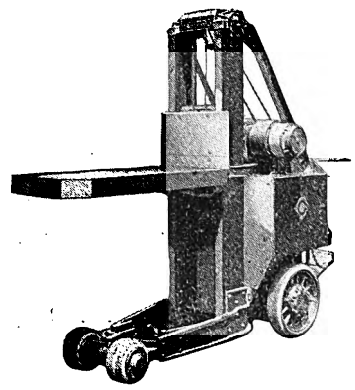
The Elwell-Parker "Hi-Lo" Tructor employs an entirely new principle of Hoist Drive. It has only two single straight running cables. Motor driven, double grooved, single drum hoist with oil immersed worm gear reduction. All moving parts are fully housed—none exposed. It has automatically-operated limit and interference stops; good clearances and ample battery capacity.

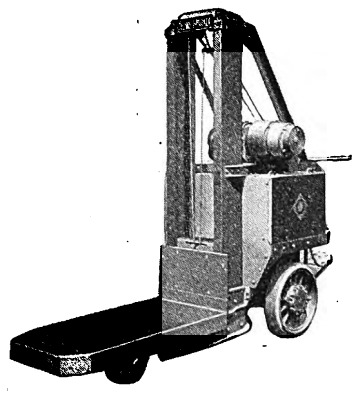
In the "Hi-Lo" Tructor, the rigid elevator uprights or ways are triply anchored to main frames. Large diameter, widely-spaced ball-bearing rollers support and guide the massive load decks—which are normally rated to electrically *pick up, carry and stack* 6000 *lbs.*

Elwell-Parker "Hi-Lo" Tructors are used similarly to the well-known electric industrial lift truck, except they elevate loads several feet instead of a few inches.

They are built with all-steel, low-hung frames, carried on sturdy broad gauge axles fitted with large rubber-tired wheels. *These tructors are equipped with larger batteries, motors, hoist units and bearings than any other machines of similar type.*

Request *your* copy of Bulletin 559.





The Elwell-Parker Electric Company

Cleveland, Ohio

Tructors

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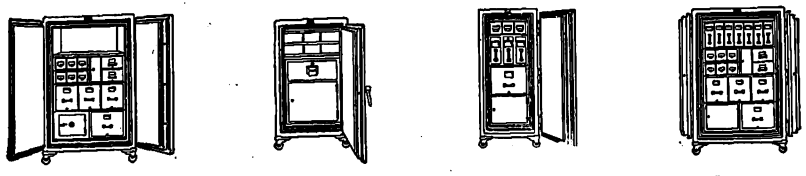
Too Late!

You Can't Save Records After the Fire Starts

Called out of bed, you learn that it's *your* office on fire! Too late to save anything. Yesterday's opportunity to protect valuables is gone. Whatever carelessness has been tolerated is going to be paid for now!

Tomorrow you must start business with whatever checks, inventories, orders, accounts, vouchers, mailing lists, production drawings, records the fire failed to reach. Those stuffed into desk drawers are gone. Those put into fire-protected safes are preserved.

Every man knows what he *ought* to do about providing adequate fire-safe storage. *Some* will do it *today*. Van Dorn Safes cost so little compared with the risks they prevent!



The interiors of Van Dorn Safes are easily arranged to accommodate any kind of material you want to protect from fire, dirt, mice and carelessness.

THE VAN DORN IRON WORKS COMPANY
CLEVELAND

Branch Offices:
New York, Chicago, Philadelphia
Washington, Pittsburgh, Cleveland

Van Dorn
MASTER-CRAFTSMANSHIP IN STEEL

What Paint Means to Maintenance

(*Continued from page* 15)

other qualifications or characteristics which should be considered. Illumination is largely affected by the surface finish of the paint. All degrees of gloss varying from a flat to a very high gloss may be obtained. More or less gloss is obtained, by the manufacturer, by varying the proportions of pigment and binder. A flat white paint would be desirable from the reflection standpoint because it would diffuse any light that fell upon it without glare. However, unless one wishes to paint often, a gloss surface is more easily washed and is usually used in plant work. The degree of gloss should be determined by the conditions. A high gloss is not required in a room exposed to bright sunlight, but in a dark room it should be used.

Another very important point is the capacity for hiding the surface under the paint being applied. This covering power or degree of opacity as it is called, is very important. Most of us know that white enamels are applied over one or two coats of flat white because, in themselves, they do not have very much covering power. This same lack of covering power occurs in white paints, although to a much less degree than in the case of white enamels. Light reflection and opacity go hand in hand. Pigments such as white lead, zinc oxide and lithopone are largely used, either by themselves or in combination with others, and they make paints with a high degree of opacity. Some pigments will take more binder than others and this naturally has some effect on the opacity or transparency of various points. However, there is not much difference in the light reflecting qualities of any paint made with a good white pigment as a base.

A paint for plant use should be washable and durable, so that dust and dirt can be washed off at frequent intervals. There are flat finishes as well as gloss finishes which may be washed time after time without appreciably diminishing the value of the paint. In fact the washable feature is one of the most important in the list of qualifications. Cold water paints have good light reflecting qualities and are opaque, but they are not washable and of course are not permanent. Any paint to be really washable must be non-porous, so that the dirt will wash off, and not into, the paint. The sanitary value of this feature is of paramount importance, especially in plants where the dust may contain poisonous matter. A paint which will stand washings after being subjected to dust, mild fumes and moisture, may be considered durable. If it can stand all these attacks and not chip or flake, its durability is settled. Good materials properly mixed will stand all these tests and one should look for them when selecting paint.

Another important point to be taken into consideration in the selection of paint is its permanency or ability to stay white. Most pigments will retain their original whiteness, but many oils which are used for binders will yellow with age especially in a dark place. There are a great many paints now on the market, however, that will stay white for a long time. The paint manufacturers have ingeniously devised methods of overcoming the yellowing effect of aging on the oils or binders and are now producing white paints that stay white.

It is quite important that the paint film should be elastic. Checking will be avoided if the film is elastic, and it is well to have both coats of approximately the same consistency so they will be less liable to checking.

Another factor which enters into the selection of paint is the ease with which it can be worked. A paint which is easily worked allows a man to apply more in a day, and in this way it is apparent that the cheapest paint is not always the most economical in the long run. Closely allied with this quality of workability, is the area which can be well covered per gallon. This is a very important point and if a large amount of work is to be done, it may be advisable to make tests. A narrow strip three or four feet wide should be painted with a like amount of the various samples to be tested, and the length of time consumed in applying, and the number of square feet covered, should be recorded. It is then possible to figure out which paint is the most economical, based on the cost of material and labor, per square foot on the wall. A test of this kind, in order to be fairly made, should be prepared for in advance, so that the painter who applies the paint will not know

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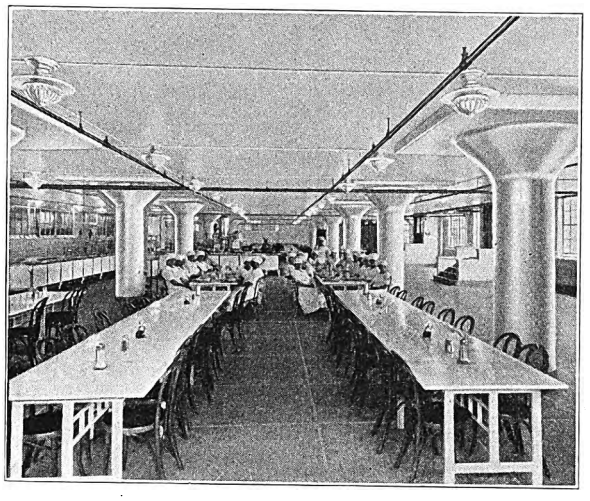
which is which. Plain cans should be numbered and the samples poured into them. The quantity should be carefully measured, and each sample should be applied with a new brush.

A good white paint should not turn yellow with age. We expect that of any good paint nowadays, and it is probable that few of us appreciate the amount of research work in chemistry, which is necessary to keep improving standards, as we have improved them in the past few years. With this improvement there has also come a great improvement in the methods of making paint, and the modern paint plants of today are very efficiently managed.

Walls and ceilings should be painted regularly. No set time for this work can be mentioned here, as each individual plant has different conditions. As a general rule, machine shops and other departments where dust and dirt alone darken the walls, they should be washed down at least every year, and preferably every six months. Painting should be done every two or three years at the most. It isn't necessary to shut down a department to paint, as this work can be done overnight and over a week-end. However, it is usually possible to paint walls and columns during working hours, leaving only the ceiling to be done overtime. Oftentimes it is possible to move through a room, doing two or three bays at a time, and moving any operators in the bays being worked on into another bay for the day. It is a well known fact that a clean, well-painted factory tends to cut down the fire risk. Men are more careful if things are clean and orderly. The lower part of walls and columns is usually painted with a dark color so that dirty finger marks will not show. This is called a dado. Being a tougher film it does not show marks from being scuffed by trucks or work boxes as much as a white wall. The tendency seems to be to use lighter colors for the dado than formerly, in order to get the benefit of the better light reflection, and also as it tends to make the men less liable to expectorate in the corners.

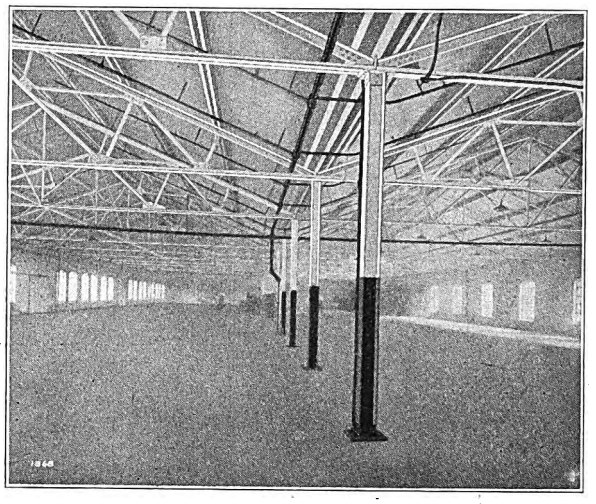
It is assumed that in maintenance work, most of the painting will be on surfaces already painted with some kind of oil paint. However, some work may have to be done on new surfaces, or on surfaces previously covered with water paint or kalsomine. These two materials should be washed or scraped off, before applying any oil paint. If the first coat is thin enough to penetrate and make a good bond, no sizing should be necessary. The first coat should overcome the action of the lime in plaster or cement, either by neutralizing, or sealing up the pores. If the walls are in bad condition the spots should be patched up before the painters start. For small spots in plastered walls, plaster Paris can be used, and on cement walls a neat cement paste with a small amount of fine sand can be used.

No paint can be expected to stick to a damp wall or ceiling. Be sure your walls are dry before starting to paint. The dust should be brushed off, or washed off a day before, to allow the surface to dry. For two-coat work on previously painted walls each coat should be fairly thin, so as not to get too heavy a coating. If the coats are of the same elasticity, they will ex-



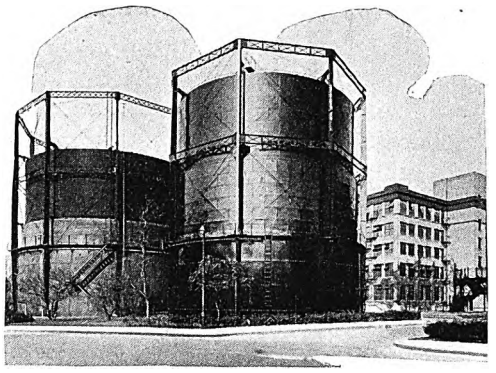
Mishawaka Rubber & Woolen Mfg. Co., Mishawaka, Ind.

60 barrels Industrial White *used for daylighting interior of entire plant, decided increase of lighting efficiency and economy of lighting. All exterior concrete damp-proofed with* Stonetex.



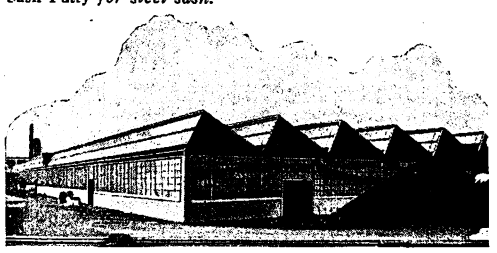
Kalamazoo Paper Co., Kalamazoo, Mich.

Cement floors hardened with Agatex—*Interior daylighted with* Industrial White—*Basements waterproofed with Truscon* Waterproofing Paste—Fibrotex *Handy Leak-proofing material for roofs, eaves, skylights*—Waterproof House Paint *for exterior wood painting.*



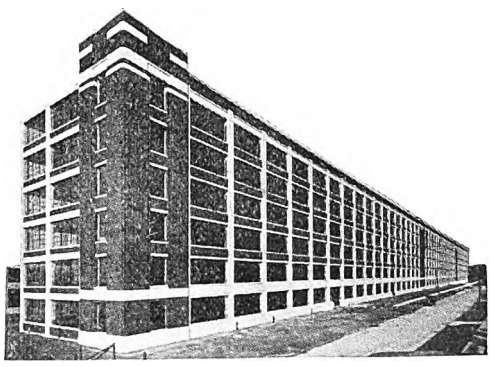
Western Electric Co., Chicago, Ill.

All exposed steel, gas-holders as well as other structurals, protected with Bar-Ox Inhibitive Steel Paint—Stonetex *for protecting concrete and masonry*—Metal Sash Putty *for steel sash.*



Continental Motors Corp., Muskegon, Mich.

Skylight and Window Cleaner *for keeping windows clear of rust and grime*—Bar-Ox *for protecting steel sash and structurals*—Stonetex *for damp-proofings exposed masonry and concrete*—Agatex *chemical hardener for cement floors*—Fibrotex *Handy Leak-proofer.*



Fisher Body Ohio Co., Cleveland, Ohio.

Stonetex *for brightening all exposed concrete and preventing disintegration—Basements water-tight with Truscon* Waterproofing Paste—Pipe Identification Paint—Radiator Flat.

A Complete Maintenance Service

From basement to flagpole—from elevator pit to roof—interiors and exteriors—for steel, wood, concrete, brick or stone—Truscon Maintenance Service is complete throughout.

Basements are waterproofed—concrete floors hardened—interiors brightened to cut down electric light bills—roofs kept waterproof—and the whole building, whether factory, office, hospital or public building, kept in spick-and-span, up-to-the-minute condition.

Such is Truscon Maintenance Service. It is the outgrowth of years of work in the Maintenance field. No other organization has the equipment, the technical training or the experience to vie with it. A thousand manufacturing plants are using it every day in one phase or another.

If you have a maintenance problem that has been giving you worry or trouble, put it up to the Truscon Maintenance Engineering organization. It may be you require a special acid-resistant paint for protecting structural steel in a plating plant—it may be a non-yellowing mill white for a rubber plant—or a special production transparent waterproof varnish—an alkali-proof paint, etc. Problems like these are daily presented to the Truscon Maintenance organization for solution. What seems difficult to you, we may have solved previously for others. Consultation costs nothing and puts you under no obligation.

Ask for the Truscon Maintenance Chart.

THE TRUSCON LABORATORIES
Detroit, Michigan.

Branches: New York, Chicago, Philadelphia, Atlanta and 24 other principal cities.

Gentlemen:

☐ Please send us the Truscon Maintenance Chart.

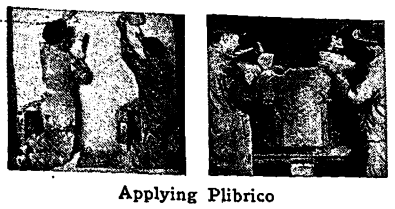
☐ Give us information on the following Maintenance problem. (Described in letter attached.)

Company..... Official.....

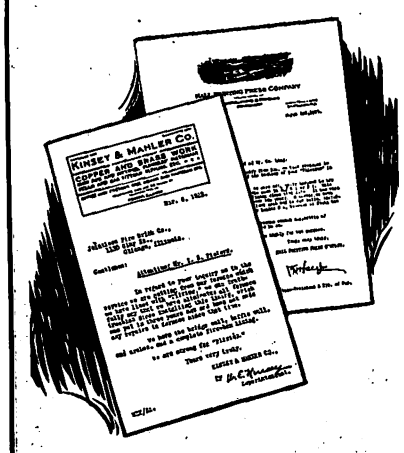
Address .....

City and State.....

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Applying Plibrico



The story that many users tell:

"Our 3-year old Plibrico Lining is still good"

IN a month, five letters were received telling of Plibrico-lined furnaces that had been in continuous service for over three years—and that were still going strong. They are typical of many letters that tell of two, three and even four years' service without relining. They came from:

Hall Prtg. Press Co., Dunellen, N. J.
Kinsey & Maller, Peoria
Thomas Dye Works, San Francisco
Gulf Coast Mch. & Sup. Co., Beaumont, Tex.
Smith & Wyman, Minneapolis

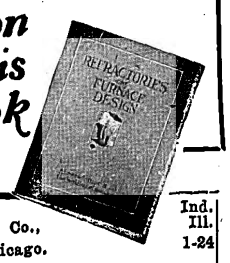
Do you get two to four years' service from fire brick linings? If you don't you need the new handbook, "Refractories and Furnace Design," that tells how jointless linings last longer, cut down heat loss and are installed by unskilled labor. Send the coupon below.

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Warehouse stocks in 60 cities—see the phone book.

PLIBRICO
FURNACE LINING
REG. U. S. PAT. OFF.

JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

The coupon brings this **FREE** *book*



Jointless Fire Brick Co.,
1154 Clay St., Chicago.

Ind. Ill. 1-24

Please send me the 32 page booklet "Refractories and Furnace Design"—no obligation.

Firm .....

Address .....

.....

Att'n .....

pand and contract evenly, thus preventing cracking of the surface. If there are spots where the suction was bad on previous coats, touch them up before starting, so as to make a good job. On new concrete walls which are smoothed up with a cement wash, the first coat should be thinned more than usual in order that it will penetrate. The next coat should be a little heavier in order to cover well. New concrete walls often require a preliminary treatment to get good results, especially if free lime is present. A dilute zinc sulphate solution is often used for this purpose and if allowed to become thoroughly dry, most paint will stick to it. Oil spots on walls or ceilings are usual where high speed belts are present. These spots should be cleaned by washing with benzine before painting. If a high gloss paint is already on the wall, it may be necessary to sandpaper it a little to roughen the surface, so the new paint will stick. After sandpapering, the surface should be wiped to remove the dust.

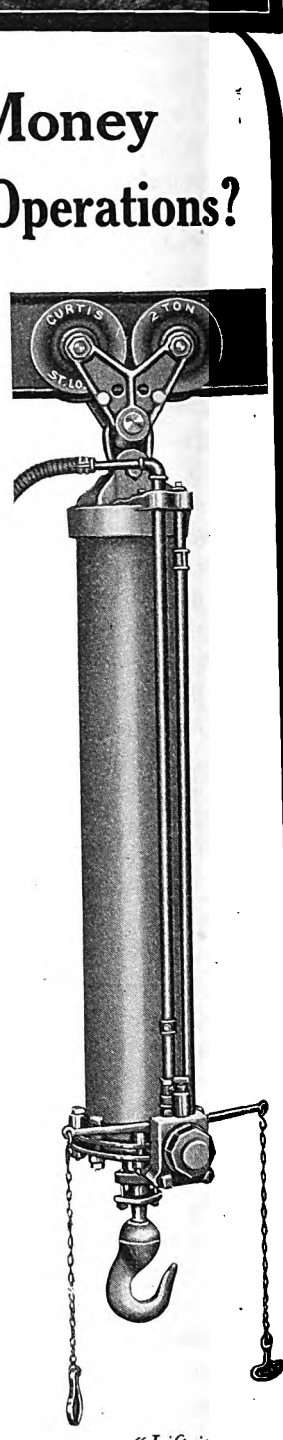
Walls of hollow tile are hard to paint, whether of plain hollow tile or plastered over the tile. These are largely used for fireproof partitions in concrete buildings. They are apt to have more suction than any other wall, and therefore the amount of thinner used will have to be doubled in some cases. Brick walls, especially of soft brick, are also apt to have a great deal of suction and will require about the same treatment as hollow tile. Metal ceilings are occasionally met with in wooden buildings in some plants. If they have been previously painted the new paint will stick well if the surface is clean. Any rusty spots should be wire-brushed clean, and these spots touched up before starting. Stains on ceilings can be overcome sometimes by a coat or two of a metal paint such as aluminum paint. In a great many cases this will prevent stains from coming through. This same method can be used on concrete, plaster or wooden ceilings.

For large areas, and especially on new building work, the spray method of painting is now being extensively used. For interior work on new buildings it is being used with success. It is necessary to have windows open to carry off the volatile fumes released while spraying. For



Do You Lose Money *Between* Machining Operations?

EVEN if your plant is equipped with the most modern production machinery, there is still a big chance for you to lose money ***between*** machining operations!....Why? Simply because you may not be ***moving*** your material with dispatch, or economy (i. e. low labor cost).



Curtis All-steel ***Air*** Hoists and Roller-bearing Trolleys lift and move any kind of material, quickly, economically and safely, making use of a power already available in most plants. They save time and energy and men—before, during, and after machining operations. With Curtis I-Beam Trolleys a 4000-lb. load can be moved by a 50-lb. pull.

Capacities up to 20000 lbs. and various types to meet your particular needs. Send for full information.

CURTIS PNEUMATIC MACHINERY CO.
1668 Kienlen Ave. St. Louis, Mo.
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CURTIS
AIR COMPRESSORS-HOISTS-TROLLEYS-CRANES
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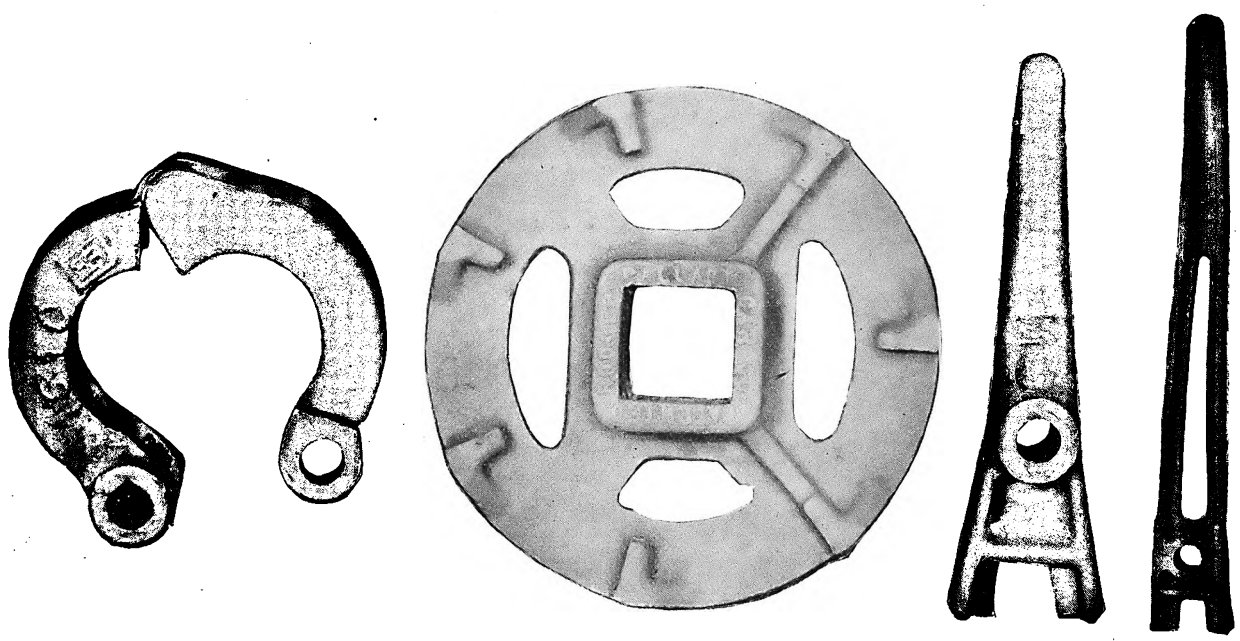
interior work where equipment is installed in the room, it is necessary to cover all the equipment quite well with drop cloths. In most cases spray painting requires ten to thirty per cent. more paint than the hand method. On the other hand, the hand method requires two or three times the amount of labor required by the spray method. The men using the spray inside a building should wear a respirator to absorb the volatile vapors and catch the small particles of pigment floating in the air. Naturally the introduction of this method of painting has met with a certain amount of resistance from the painters, and in some cases it is necessary to train new men in the use of this equipment. There are certainly a great many places, which otherwise would not be painted by hand, which can be easily sprayed, and in this way preserved. Tanks and other large blank areas can be easily painted by this method. When the spray is used out of doors the volatile vapors are carried away by the wind, and this method is very well suited for this work.

Concrete floors which are exposed to heavy wear may dust, in which case they may be hardened or painted. There are various kinds of hardeners on the market which give good results. Water solutions of sodium silicate have been used with considerable success as hardeners. Floors hardened in this way can be painted later on if desired. On basement or ground floors, where the concrete is laid on a cinder fill, there are apt to be alkali conditions present which can be neutralized with a water solution of acetic acid, to which a little alum and blue vitriol have been added. This should be brushed onto the floor and allowed to dry, after which the floor may be painted. Most floor paints are made with a pigment which resists wear and a hard resin varnish.

This makes a surface which resists wear and improves the surface. Most good floor paints are not affected by oil, water or grease, and therefore protect the ceiling below from oil stains. Wooden floors may be painted with a preservative to lengthen their life. This is best done while the floor is comparatively new and before it is rutted or chewed up. Trucking aisles should be painted with a white line about three inches broad. This line acts as a dead line, outside of which no one is allowed to pile goods. It is surprising how much time is lost in the average plant by truckers who cannot pass one another without pulling out of the way. Painted trucking aisles may seem to some folks to be a waste of good piling space, but they tend to make an orderly plant and certainly save time in moving materials.

Where pipes are painted with different colors to identify them, it is easy to find them in an emergency. This is especially true of sprinkler and ammonia pipes. Sprinkler pipes have been painted red for a good many years, but the use of colors on the others, such as ammonia, compressed air, steam, water, oil gas, hydraulic and drain pipes, is a practice which is gradually being introduced into all plants of any size. A set of standard colors should be adopted at the outset. Most paint manufacturers have a standard set. Pipes covered with asphalt, such as soil or drain pipes, are some-

(*Continued on page 37*)



Doing Away with One of the Principal Causes of Defective Castings

Shop defectives, that is, castings rejected by the foundry inspectors, are a heavy item in foundry costs.

One of the principal causes of shop defectives is the shifting of cores.

Thorough analysis of the experience of the Nugent Steel Castings Company and that of a number of other steel foundries shows that shifting is much more common when stock cores are used than when special cores are made for each pattern.

This, of course, requires excellent core making equipment in the foundry.

How this has been provided by the Nugent Steel Castings Company is described in one of our bulletins.

Rejections $\frac{735}{100,000}$ of 1%

During the last twenty-two months we have furnished a certain customer 1,050 tons of castings comprising 81,588 separate pieces. During that period the customer has returned to us as defective a total of 6 pieces. The percentage of defectives is, therefore, 735/100,000 of 1%—a percentage so small that it indicates a truly phenomenal foundry efficiency.

This D series of bulletins will be sent free to anyone requesting it on business stationery.

NUGENT STEEL CASTINGS COMPANY
formerly ELECTRIC STEEL COMPANY
31st and Wood Sts., CHICAGO

NUGENT STEEL

NS

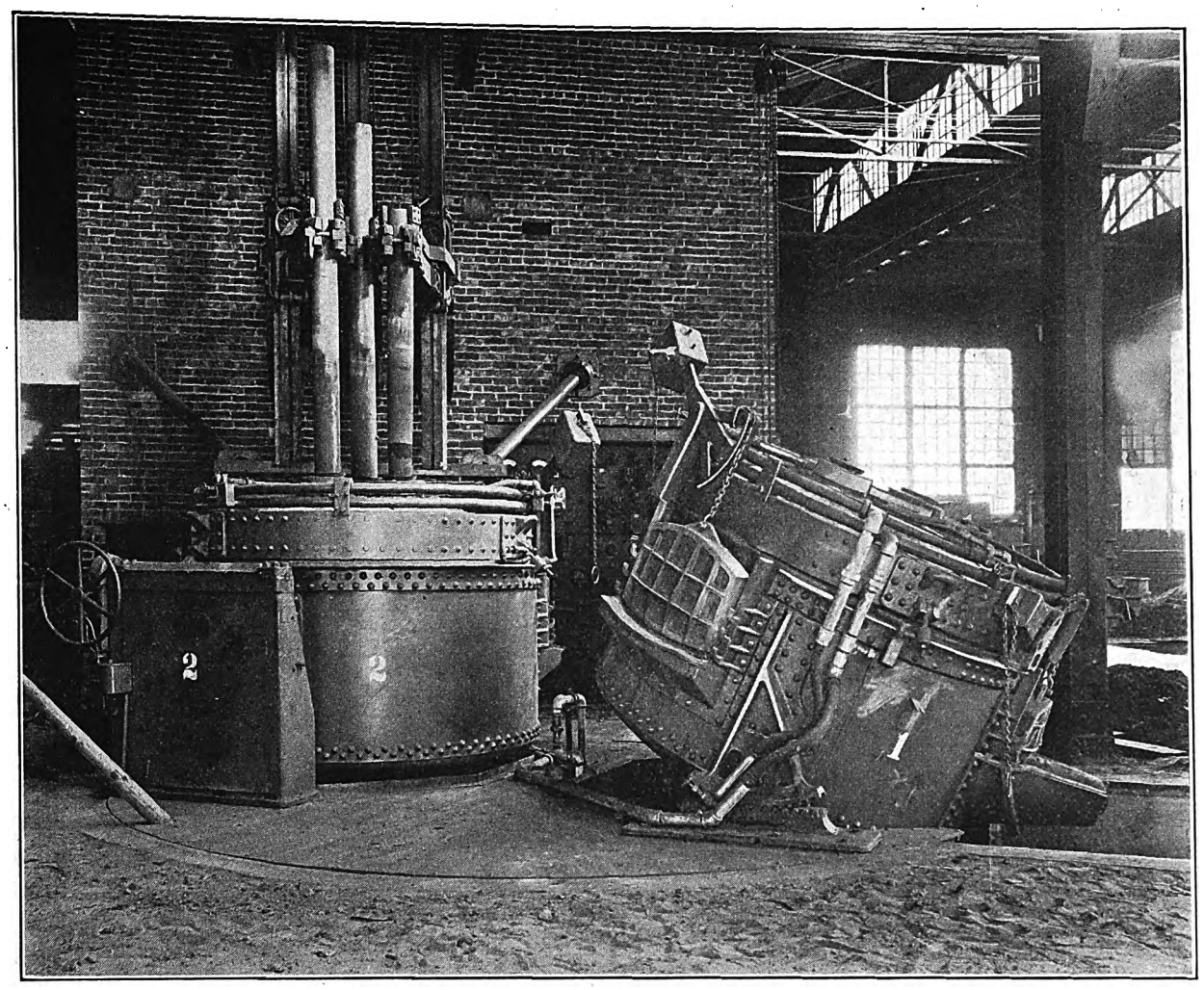
Reducing Castings Inventories with Better Delivery Service

Many purchasers of steel castings frequently overlook one outstanding advantage that can be gained by buying from a properly organized and favorably located foundry such as the Nugent Steel Castings Company. That advantage is the saving that can be made by keeping down inventory.

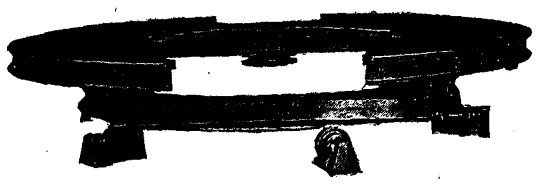
One of our out-of-town customers has found during the past year that our ability to deliver with uniform regularity and on short notice has enabled him to reduce his monthly inventory of castings by $30,000. Excellent deliveries freed him from the necessity of anticipating his requirements by carrying large stocks.

WE SPECIALIZE IN THE PRODUCTION OF INTRICATE AND THIN SECTION CASTINGS

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The Turn Table that Solved a Foundry Production Problem



Showing the construction of the Easton Turn Table, specially constructed for the above installation

Comparing the modern foundry to its prototype of a few years back is like comparing the present system of industrial conveying and handling machinery to the old and costly system of wheelbarrow transportation.

In the foundry as in every other branch of industry great strides toward continuous production have been made and it has been among our experiences to aid in the design and installation of a turn table for two electric furnaces, which made possible continuous operation and the lowering of production costs.

In this installation only one set of electrodes and electrical equipment is made necessary. And through the use of the turn table one charge can be poured while the other furnace is undergoing repairs and cleaning. Thus the turn table is not only an aid to continuous operation but also saves the great expense of one set of electric equipment.

This installation is but another example of the diversified character of our work and the extent of our ability and experience.

You may have a handling problem which requires special applications and plans. Our engineers stand ready to give you the benefit of the experience gained on thousands of installations.

EASTON CAR & CONSTRUCTION CO.

EASTON, PA.

SALES OFFICES

Hudson Terminal, New York
Morris Building, Philadelphia
Kunkel Building, Harrisburg
Jefferson Building, Birmingham
Oliver Building, Pittsburgh
McKevitt Building, Norfolk

EASTON CARS

FOR EVERY INDUSTRIAL PURPOSE

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(*Continued from page* 35)

times hard to paint. A good way to overcome this trouble is to put on two coats of aluminum paint. This will hold in the asphalt, and the pipe can then be painted in the usual way. Pipe coil radiation in the plant is usually painted the same color as the dado or black. Most of the dado colors will not change color when subjected to the heat in a pipe coil radiator, and are therefore all right to use. In fact, the practice of painting office cast iron radiators with aluminum paint or bronze paint is being given up by those who claim that oil paint is better because it has a higher radiating efficiency.

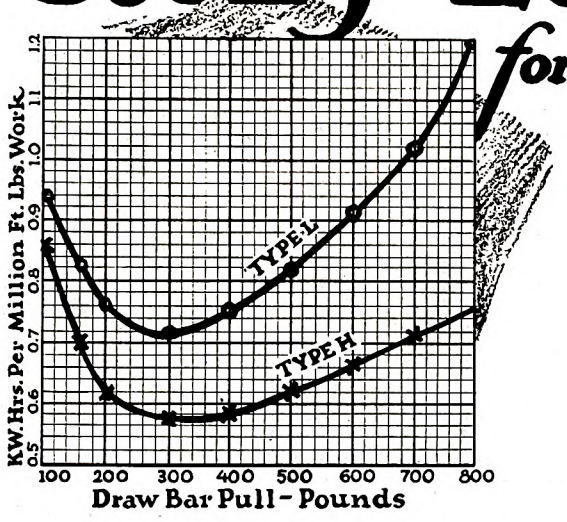
The use of special paints for special purposes is gradually becoming more prevalent in plant maintenance painting. For each particular surface there is a paint which is best. It is evident that a paint which is good for steel work would not stand up on a boiler front or a hot flue or stack. Metal surfaces, subject to air with moisture, are very much subject to corrosion, and this is very greatly speeded up by the presence in the air of sulphur and soot, such as we get in the air of most cities. A great deal of corrosion can be avoided by proper painting. Steel or iron surfaces which have been rusted should be brushed with wire brushes and scraped with chisels if necessary to get down to the steel. A priming coat containing one or more of the basic or chromate pigments followed by a coat of carbon or iron oxide paint will protect steel or iron from corrosion for a long time if the conditions are average. For special conditions, however, some other treatment may be better.

The time is coming when all machines, instead of being painted in the usual black or very dark colors, will be painted light gray or some other light color. Most operators will take pride in their machines if the management will lead the way by improving the appearance of the machines. From the standpoint of lighting, both by daylight and artificial, it is evident that light colors on machinery will reflect more light and actually save money on lighting bills. Bench legs and all other stands and movable equipment may also be painted the same color as the machinery.

Tin roofs require frequent inspection and touching up. If rusty in spots, the surface should be wire brushed and given a priming coat of red lead and a coat of any good roof paint. If repairs are required on any of the built-up types of roofing, a thin elastic cement paint can be used. Glazing is usually done by the painters. Lighting by daylight can often be diffused to a better degree by the use of prism type glass. This glass tends to bend the light rays into the middle of the room and will help a great deal in a room which is dark a short distance back from the windows. The inside of steel sash, as well as a great many other metal surfaces inside the plant, can be painted with the wall paint. However, the outside of the steel sash should be painted with a metal protective paint as noted above. Steel work, such as fire escapes, skylights and ventilators, exposed to the weather, also require metal protective paints, as noted above in the treatment of steel and iron surfaces. The steel work on bridges, as well as the corrugated iron covering,

(*Continued on page* 39)

Use 25% Less Electricity for the Same Work



THE design of an electric tractor determines how many kilowatt hours of electricity you must put into that tractor's batteries to do your work.

The new Mercury Type H requires 20% to 40% less energy than the best of the worm driven models. Look at the accompanying curves showing this saving in kilowatt hours for various draw-bar pulls.

This means that you can charge the batteries in a Type H tractor at a lower rate, or for a shorter period, or at greater intervals. Any way you fix it, you save 20% to 40% on power bills for your industrial hauling.

How The New Type-H Makes This Possible

Introduces a balanced internal gear drive of entirely new design, eliminating the friction losses inherent in the worm drive. This results both in low operating cost and an absolute minimum of upkeep for the "power plant."

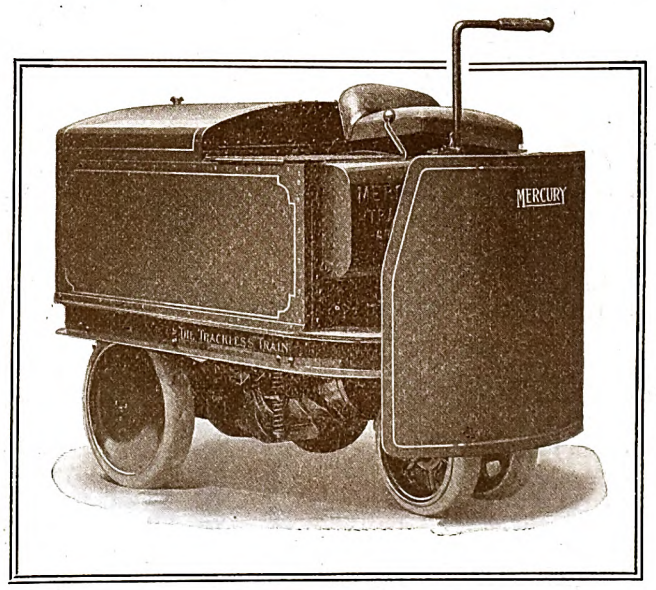
Retains all valuable features developed in previous Mercury models including:

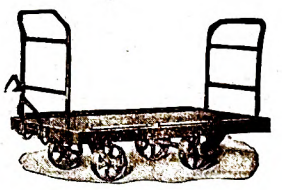
1. Special safety features effectively insuring against danger, even in the hands of inexperienced workmen.
2. Drum type controller of special design having long life, dependability, simplicity, ease of inspection and adjustment.
3. The exclusive Twin-3 front wheel assembly combining full spring suspension with the short turning radius of older 3-wheel models.
4. Frame of channels and angles hot riveted to combine maximum simplicity, rigidity and strength.

Fleet Owners

The Mercury organization pioneered in the field of electric industrial tractors, and for more than 8 years has made such tractors and trailers exclusively. It is therefore not surprising that a preponderance of all the large installations are 100% Mercury. A few of the large fleet users (over 10 machines) are the following:

American Railway Express Co.
American Radiator Co.
Armour & Co.
American Window Glass Co.
General Electric Co.
Endicott-Johnson Co.
United States Government
Studebaker Corporation
Sugimure Warehouse (Japan)
Willys-Overland Co.
United States Government
American Car & Foundry Co.
Kewanee Boiler Co.
Eastman, Gardiner Lumber Co.
Standard Oil Co.
Union Stock Yards & Transit Co.
Pennsylvania Railroad Co.
Sears, Roebuck & Co.
Illinois Central Railroad
Lehon Co.
Morris & Co.
Swift & Co.
Miller Rubber Co.
Chicago Tunnel Co.
Chicago Union Station Co.
Chicago Burlington & Quincy R.R.
New York Central System





Trailers

And to complete the "Trackless Train" there are Mercury trailers of just as distinctive merit as the tractor. There are various designs for special purposes, but the A-310, illustrated above, is an all-purpose trailer which meets most all ordinary industrial conditions.

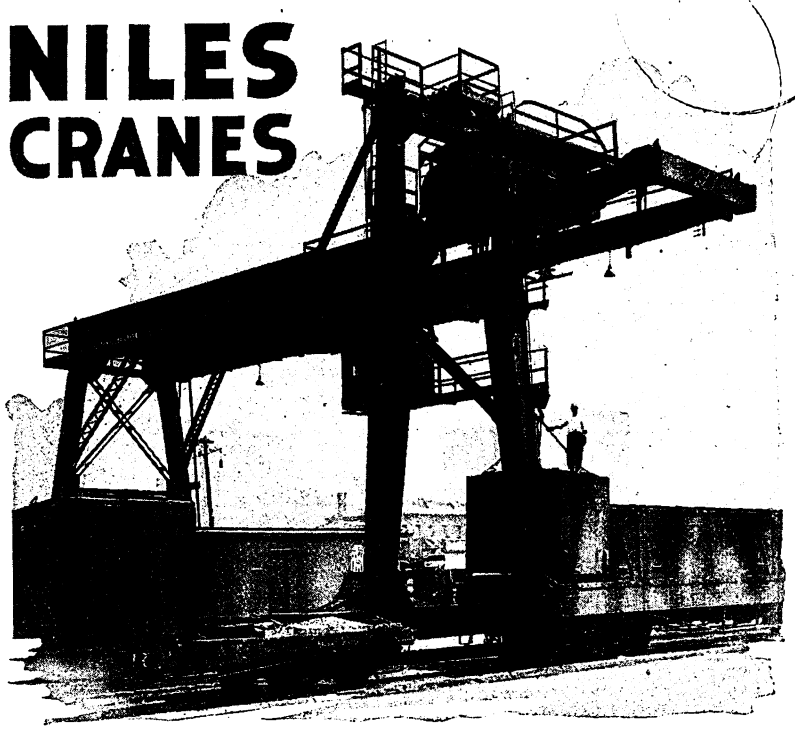
Mercury Manu[illegible]ring Company

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Speeding Up Uncle Sam's Mail

THIS 40-ton Niles Gantry Crane installed in the New York yards of a large Eastern Railroad handles mail and freight from cars to trucks in *half the time* formerly required.

Since speed, ease of handling and absolute reliability are main requirements for the crane doing this work the Niles Crane was selected.

We build Niles Cranes in Electric Traveling, Jib and Wall types up to 200 tons size and larger. Our engineers will be glad to advise you in any of your transportation difficulties.

NILES CRANES

For the Steel Mill, Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy material must be handled with speed, safety and economy.

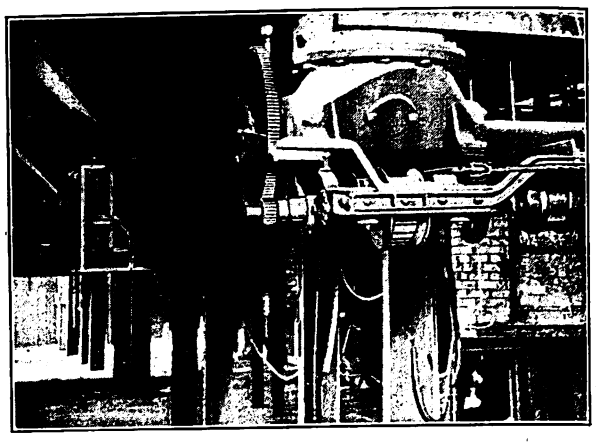
NILES-BEMENT-POND CO.

111 BROADWAY—NEW YORK CITY

CRANE WORKS— PHILADELPHIA, PA.

No. 9 *of a series illustrating the many industries served by Niles Cranes.*

Courtesy of Raymond Bros. Engineering Co., Chicago, Installations of 8 No. O-D Reeves Transmission, Illinois Malleable Iron Co.



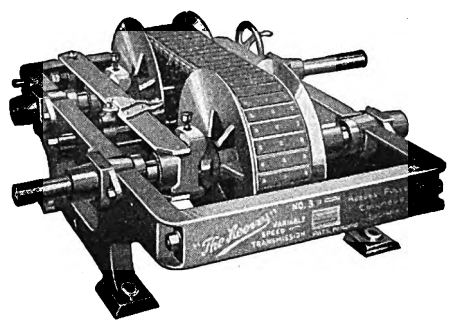
"The Reeves"

VARIABLE SPEED TRANSMISSION

INFINITE SPEED VARIATION

Easily and quickly obtained

Simple to operate. Inexpensive to maintain. Reduces cost to such an extent that it pays for itself in a very short time.



"THE REEVES" Variable Speed Transmission, as now manufactured, represents the most perfect mechanism procurable for the purpose of transmitting VARIABLE SPEEDS.

Its appeal to users is based solely on its ability to not only save money but to increase production and improve the quality of his goods.

The eight annealing ovens shown above cut, formerly required a man at each furnace, as well as a complement of coal passers to maintain the proper heat. Since the adoption of "The Reeves" Transmissions on the new pulverize coal system, one tender and his assistant now operate the entire battery.

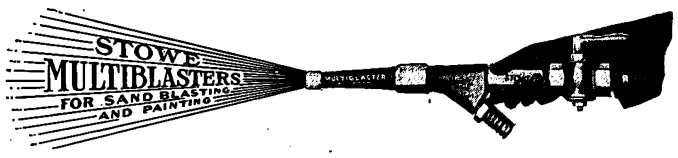
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REEVES PULLEY COMPANY

Columbus, Indiana

A Sand Blast as Powerful and Durable as the most costly at $30.00

A Paint Spray that leads in Economy, Durability and Efficiency at $12.00



STOWE MULTIBLASTERS (both sandblast and paint spray) sell at the lowest price on the market. But in effectiveness, adaptability and money saving qualities, they are leaders in their line.

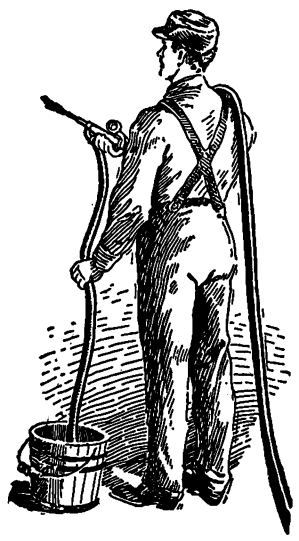
One man with a MULTIBLASTER can do the work of a gang of six at either sandblasting or painting and do it better. The MULTIBLASTER affords uniform distribution of the sand or paint which is drawn into the spray by suction.

ALL MULTIBLASTERS are portable, require no installation of tanks and can be used anywhere. Sand is syphoned from pit, barrel or pile—paint from any container. Compressed air does the work.

Our 10 Day Trial Offer

will enable you to prove the value and superiority of the MULTIBLASTER before you actually buy it. We will send you any outfit listed below, ready to attach to your airlines for 10 days' free trial. Write for yours today.

	Price	Weight lbs.	Hose Suction In.	Pressure lbs.
Standard Size Sand Blast	$30.00	8	1	80-90
Medium Size Sand Blast	18.00	6	¾	60-70
Bench Size Sand Blast	15.00	3	½	40-50
Paint Spray	12.00	2	½	40-50



"The Man Behind the Gun"
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Geo. M. Stowe, Jr.

MANUFACTURER

68 Forest Avenue Buffalo, N. Y.

STOWE MULTIBLASTER

MADE IN SIX STYLES

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Ceiling Fixtures

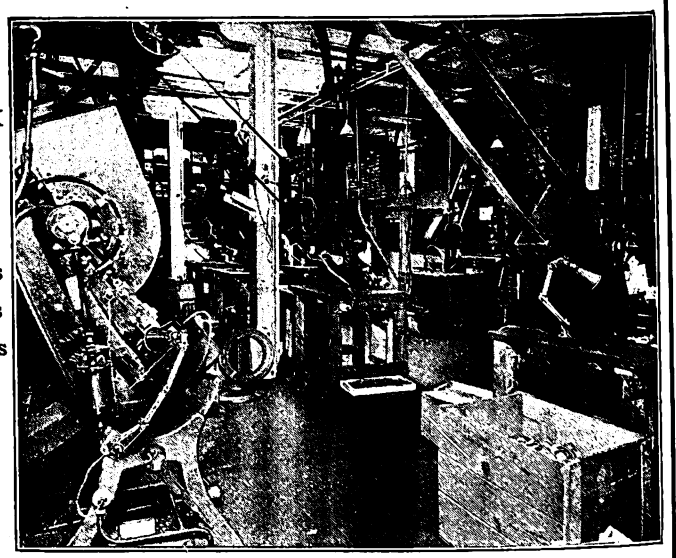
Floor Fixtures

Wall Brackets

Bench Fixtures

Machine Fixtures

Portables





More Work per Man

That's just exactly what "American" Adjustable Fixtures will do for you—are doing right now in such large concerns as

Allis-Chalmers Mfg. Company
Phoenix Knitting Mills
National Lamp Works
Westinghouse Electric and Mfg. Co.
Cutler-Hammer Mfg. Company
Illinois Watch Case Company

The light will "stay put" regardless of vibration—on work bench or stamping machine, the operator's light is held firmly, free from glare and eye-strain, right on the job in hand. The patented Universal joints take care of that.

AMERICAN FIXTURE COMPANY, 230 West Water St.

MILWAUKEE WISCONSIN



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(*Continued from page 37*)

equire the same treatment. Steel tanks and their structural steel supports are another item to come under the treatment for steel and iron surfaces.

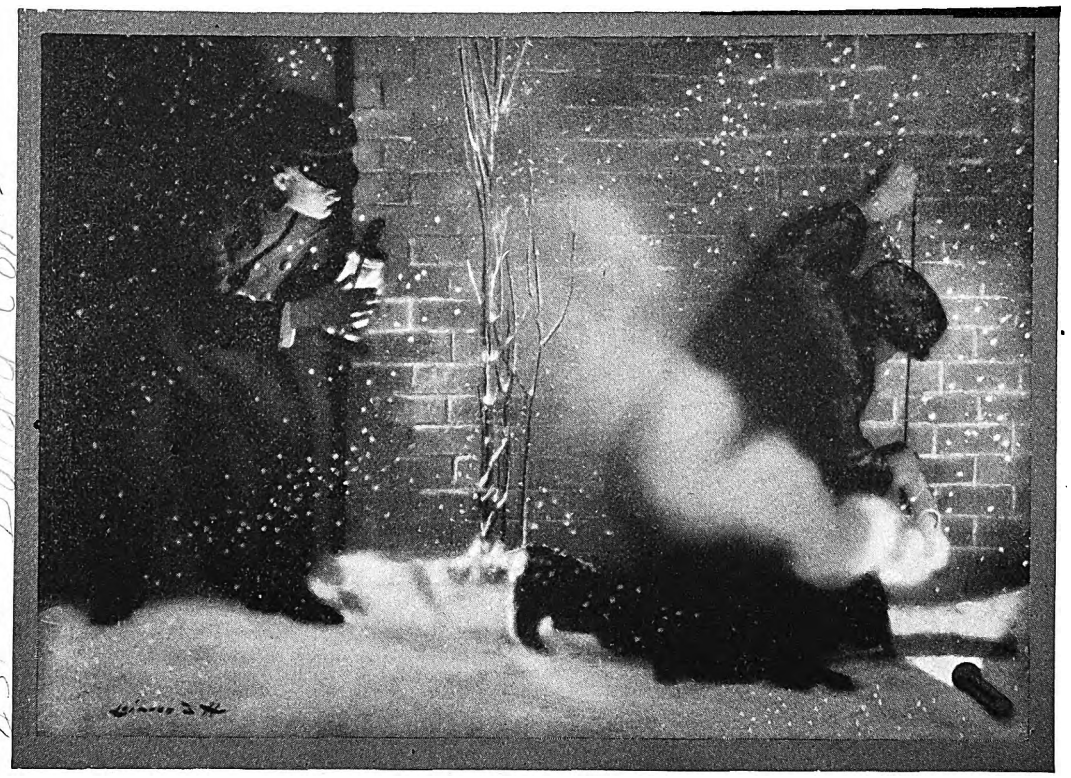
Exterior concrete, which was not well rammed and finished at the time of construction, is apt to take up moisture during rainstorms, causing dampness in the walls. A concrete paint which will protect against the weather will prove a paying investment, as sooner or later the moisture and consequent frost getting in will disintegrate the concrete and cause lumps to break off. Most concrete paints are of a color nearly like the color of the concrete itself and they should be of such a composition that the action of free lime or alkali in the concrete will not affect them. Exterior painting can usually be most economically done from a swing staging hung from the roof. However, for low buildings, a built-up staging may be best. There are on the market portable stagings which can be erected and taken down any number of times. For interior painting in the plant with twelve or fourteen-foot ceiling heights, the usual folding horses provide an economical method of staging.

Sheds, fences, hydrant houses, and other outdoor surfaces should be painted with a good weather resisting paint. The location of fire boxes and apparatus can be more readily seen if round red spots are painted on the walls. Numbers on buildings are also more conspicuous if they are made with white stenciled numbers on round black spots. These spots need be only eighteen inches in diameter, but the red spots for fire apparatus should be at least three feet in diameter.

Rust and decay will soon cost more by requiring replacement of original materials than the cost of maintenance painting. There is no question but that maintenance painting pays, and in a plant having quite a large area, one or more painters working all the year round is the most economical method. Outside work can be done in good weather, and the men transferred to inside jobs during rainy weather. A painting department should have covered cans for rags and waste, and the floor should be kept clean to avoid fire danger. Large supplies of paints, oils, and thinners may be kept in the fireproof oil storage room and drawn on requisition in small quantities every few days, and kept in tightly covered tanks or cans. Supplies such as brushes should be kept in the stockroom and issued as needed.

A yearly inspection of the entire plant is the best method of finding places where rust or decay are starting. These surfaces can then be painted, and in this way expensive replacement is not needed. To be of the most value, this yearly inspection should be made by someone who is acquainted with the work, so that he can make valuable suggestions. A record of this kind over a number of years will be of invaluable assistance in picking the kind of materials best suited to the individual jobs.

Even at the risk of being tiresome, it is worth-while to call attention to the old adage about "a stitch in time." Delay in painting does not merely mean postponement—often the surface which *should* have been painted, has passed beyond the stage where paint would save it.



Where the Facts Came From

You may want the facts that form the basis of this dramatized incident. We can give you, on request, information on many installations where savings several times as great have been effected. In one case a western manufacturer was able to discard three of his four boiler plants after his *Grinnell forced circulation hot water heating system* was installed. The booklet, "Five Factors in Heating Cost," will be sent to any one interested in heating industrial buildings. Send for a copy today. Address Grinnell Company, Inc., 307 W. Exchange St., Providence, R. I.

Have you a Bolshevik like this in your plant?

President: "Jim Carney—impossible! I'd as soon suspect myself of being a Red. Why, he started with us in the old works on River Street. We were planning to retire him on a tidy pension in July."

Production Manager: "I wouldn't believe it myself, but how do you explain this? As foreman he has always just lived in his own department. Lately he's been hanging around the engine room a lot. Never used to miss a day. Lately, he's been off constantly and yesterday we saw him go into the building in which a group of radicals has offices. Last night, with the thermometer below zero, the watchman saw him out behind the boiler house. Thought he saw the glint of a pistol. But this morning when we searched his overcoat all we found was a steel tape line."

Chief Engineer: "And last Thursday my assistant found him behind the separator examining the exhaust pipe vent in the wall. He told me that it would be simple to move a charge of dynamite in from the outside and blow the engine room to pieces."

President: "But what does Jim say?"

Production Manager: "That's the worst of it. He won't talk. Seems abstracted. When he left this afternoon all he said was that if anything special came up he could be reached at Main 761. It's up to you or the police department to wring the truth out of him."

President: "Main 761—why that's our Consulting Engineer's number. I'll call him right up."

* * * * * *

Half an hour later the Consulting Engineer and Jim Carney entered the President's office.

"Well, Jim," said the President, "what are you up to now?"

"It's that pension, sir," stammered Jim, "I——"

"Perhaps I'd better explain," smiled the Consulting Engineer. "I'm afraid Jim's a little too modest. About a month ago he came to me and said he had heard he was going to be pensioned off. Before he went he wanted to do something big for that $600 a year."

"Something big—what do you mean?" cut in the President.

"It seems your old Superintendent Swanson turned him down pretty hard on a proposition he submitted and Jim said he didn't want to bring it up again until he had all the facts. I saw he was on a big thing and I agreed to keep it quiet and help him work it out. You see it was all in appreciation of what the firm was going to do for him. The figures came in today and I had just told him before you called up that in return for his $600 pension, he was presenting you, his chief, with a pension of $5,000 a year as long as your business lasts."

President: "You're joking—why, it's preposterous!"

Consulting Engineer: "Not at all. Jim read a Grinnell advertisement about heating a plant with exhaust steam. Didn't know how, you understand, but he stuck to the idea and collected the data we needed for——"

Production Manager: "But $5,000 a year, that's the cost of our whole year's heating!"

Consulting Engineer: "Right! Grinnell Company, whom I always depend on for such special systems, finds that the exhaust steam from the generating plant will run a hot water heating system and save the entire fuel bill—$5,000 a year. That's what Jim's been doing."

Production Manager: "That explains a lot."

President: "Jim, old man, I told them you couldn't—why, old boy—why, Jim——."

GRINNELL COMPANY

Automatic Sprinkler Systems | Steam & Hot Water Heating Equipment | Humidifying and Drying Equipment | Fittings, Hangers and Valves | Pipe Bending, Welding, etc. | Power and Process Piping

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Tom Jones, operator, is wasting your money

IT isn't his fault. You require him to keep the time of the various job lots which pass through his machine. It is a job that he was never trained for—and of course he makes mistakes. He guesses to the best of his ability and that is as good as you can expect.

A Calculagraph on the other hand would stamp on each job ticket the starting, stopping and *elapsed time*. There could be no errors, for all calculations would be mechanical. Your cost records would be accurate and you would save the time of operators who were never meant to be time clerks.

Write today for our booklet "ELAPSED TIME RECORDS." It describes the Calculagraph and its application to your business.

The Calculagraph Company

34 Church Street **New York**



The Calculagraph is being used successfully in the following industries

Aluminum Wear
Ammunition, Guns, etc.
Auto Accessories
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Automobiles, (Motors & Bodies)
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Brass Goods
Brushes
Candy Mfrs.
Cans
Carpets and Oilcloths
Chairs
Chemists
Clothing
Colleges and Universities
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Flour Mills
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Fountain Pens
Furnaces, Stoves, Ranges
Furniture
Garages
Hardware
Heating Apparatus
Inks
Japanese Goods
Jewelers, Silversmiths
Knitting Mills
Laces
Lamps
Lanterns
Leather
Lumber
Machine Shops
Machinery, Iron & Sheet Metal Workers, etc.
Metal Furniture
Mining
Optical Goods
Paper
Pianos and Organs
Plumbers' Supplies
Power Houses
Printers, Publishers, etc.
Private P.B.X.
Produce
Pumps
Radio
Railroads and Supplies
Refrigerators
Rolling Chairs
Roofing Supplies
Rubber Mfrs.
Scientific Instruments
Shade Rollers
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Planning the New Building

(*Continued from page* 11)

reals a more continuous and steady development in the field of machinery and labor saving devices than it does in the development of the factory building and its equipment. For a long time little thought was given to the plan and design of the building, and the principal concern for these seems to have been to provide the four walls and a roof to house the new machinery. It was probably only about twenty years ago that attention was called in any marked degree to the important part which a building might play in increasing production and lowering its cost. This idea has grown and taken firm root, but it is by no means recognized universally. This is very apparent from the many industrial plants that are continually being erected whose buildings are strong evidence that they have not had the consideration and study which is essential for the greatest efficiency and success in any manufacturing business.

Since nearly all modern factories now have labor saving and automatic machines which are more or less perfectly adapted to the most economic production of their products, the opportunity to surpass the competitor in the struggle for increased business evidently does not lie in the direction of improved machinery. The changes have nearly all been rung on this score, and it may be assumed generally that all manufacturers are about on the same footing as far as improved machinery is concerned. To what source, then, can a manufacturer turn for the future development of his business and an improvement in the economic production of his product and the increase of the intrinsic value of the product itself?

In a survey of the possibilities of such improvements, based upon the present character and conditions of the great mass of manufacturing industries, the one outstanding opportunity which promises the largest return, and seems to invite the most serious consideration by every one concerned, is the possibility of the improvement and development of the industrial building itself and its equipment and appointments.

Such a statement no doubt will not appeal to nor meet with sympathy among those who have never given serious consideration to the important part which a well planned and well designed industrial building may be made to play in the production of a manufacturer's product. This is perfectly natural, for the peculiar and yet very important reason that it is absolutely impossible for any one who is not specially qualified as a skilled designer and planner of buildings to tell whether the design and arrangement of a building is ideal or not. Even an expert cannot determine this without a careful study of the problem after acquiring a knowledge of its requirements, unless the defects of such a plant are most pronounced. A plant may be far from what it should be and yet appear to be in every respect well adapted for the use to which it is put. As a matter of fact, there may have

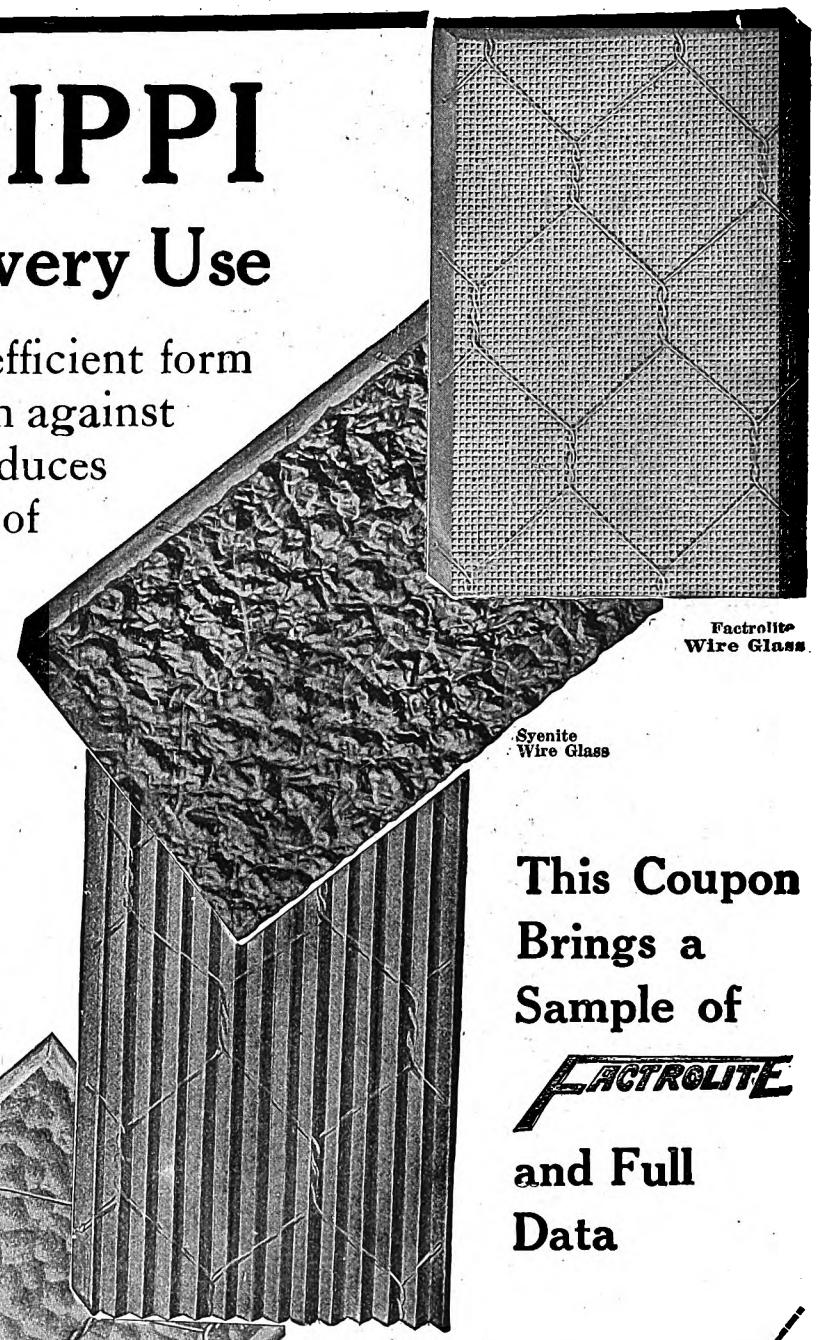
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been ways by which that same plant could have been built so that very important additional advantages and betterments could have been secured not only in the methods of production, but also in the quality of the product itself.

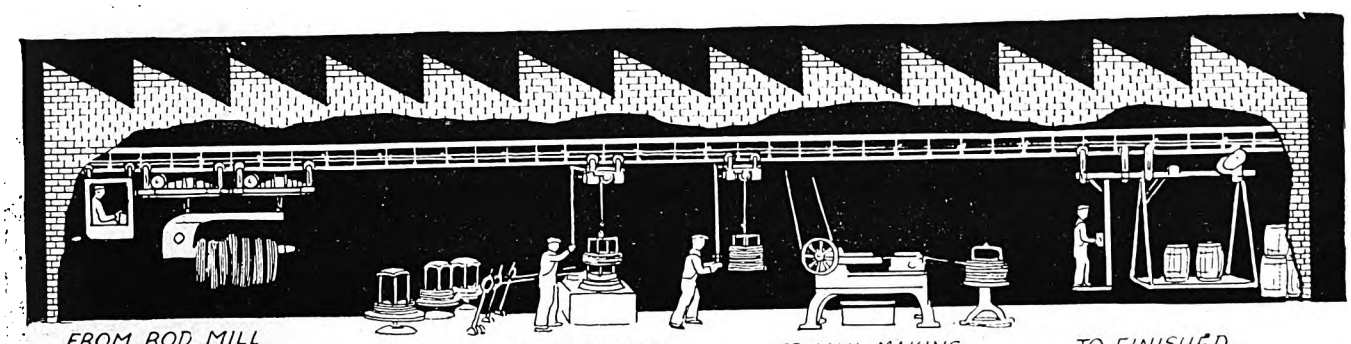
How, then, can the building affect materially the production of the product and reduce its cost? The answer to this question covers a multitude of things and varies according to the kind of industry concerned. Different kinds of industry have established in some cases quite definite types of buildings, and then there are the multi-story factories in the crowded districts of cities and the great expansive plants where space is available to spread out and build any kind of buildings desired. There are those types of buildings devoted to the production of food products, shoes, textiles, clothing, steel, iron, etc., yet notwithstanding this, the principles underlying the efficient planning and designing of buildings will be found in the main to apply quite generally to all these different types.

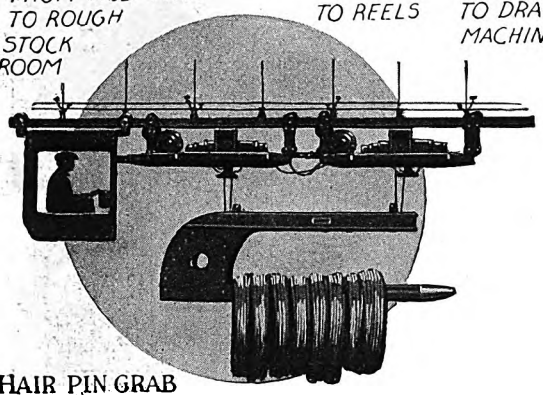
While a building may not claim much credit for the advantages of its location, still it is equally true that a building can not perform its functions best unless it is located so as to fulfill the important requirements, such as: The center of the market for the sale of its product; proper access to materials and supplies; good transportation; opportunity for securing the most suitable employees; favorable building conditions and power requirements; room for expansion; proper foreground and surrounding conditions, and opportunity for the recreation and housing of employees.

In a manufacturing industry, the making of the product usually involves several distinct processes, which originate in the open yard, in separate buildings, or in different rooms or departments of the same building. The raw material may be a single substance or a number of substances that require preparation before they can be incorporated in the make-up of the product. As production proceeds, other substances or parts made perhaps by some other manufacturer, may have to be combined with the original ones. The various processes may be simple or complex in the extreme. In fact, the operation of a single plant may be so complicated that its various processes of manufacture may extend out from the main flow of production like the tributaries of a great river. However, the flow of the production must not be allowed to wind or bend materially from its direct course, and there must be no obstacles to retard its course.

The parts of the building, therefore, should be so arranged that in the manufacture of the product, the raw material is made to travel logically and directly through the plant from

(Continued on page 46)





HAIR PIN GRAB DESIGNED *for* CARRYING RODS FROM MILL TO ROUGH STORAGE *or* DRAWING ROOM

CLEVELAND TRAMRAIL SYSTEM

HAND-OR-ELECTRIC



PUSH BUTTON CONTROL CARRIER DESIGNED TO REMOVE BUNDLE *of* RODS AS THEY ARRIVE FROM ROD MILL AND PLACE THEM *on* REELS *for* DRAWING.

Just what the Wire Mill needs for a steady and easily handled supply of bundles and coils in and through every department from rod mill to shipping department

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Its possibilities are unlimited.

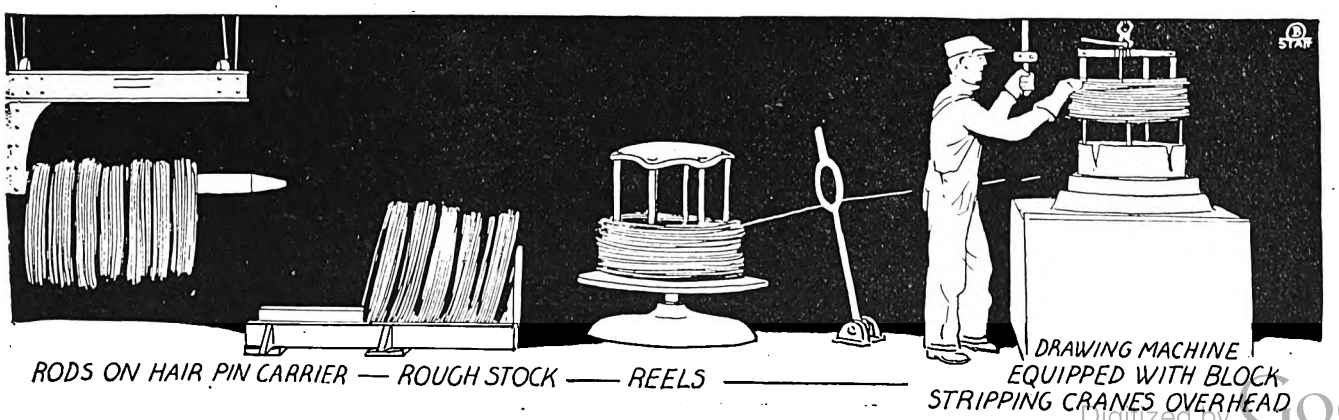
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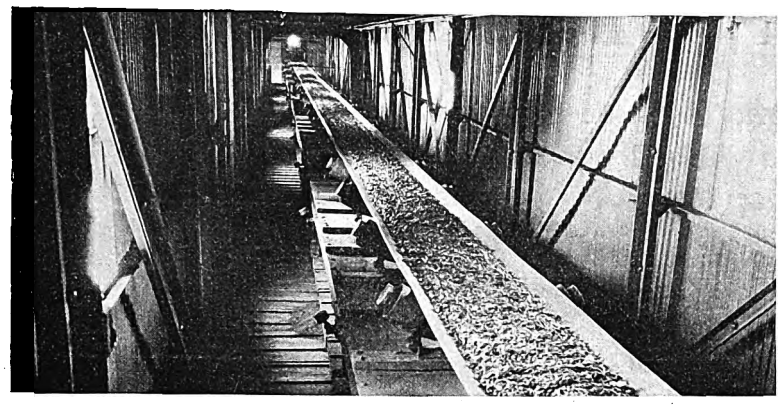
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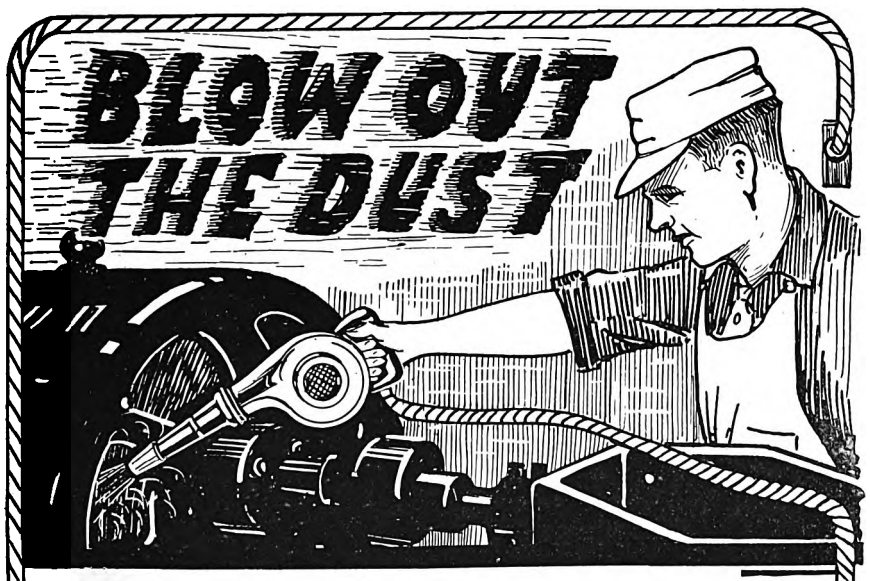
ANY equipment that reduces the cost of handling your bulk materials and products in the process of manufacture automatically increases your profits. The carrier that pays the biggest returns on the money invested for its installation, cost for operation and upkeep is the ***Belt Conveyor***.

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With a CADILLAC Portable Electric BLOWER

The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc.

Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

Weighs only 6 lbs. Complete in itself and requires no expensive installation or equipment. No condensation as with compressed air. Attached to any light socket.

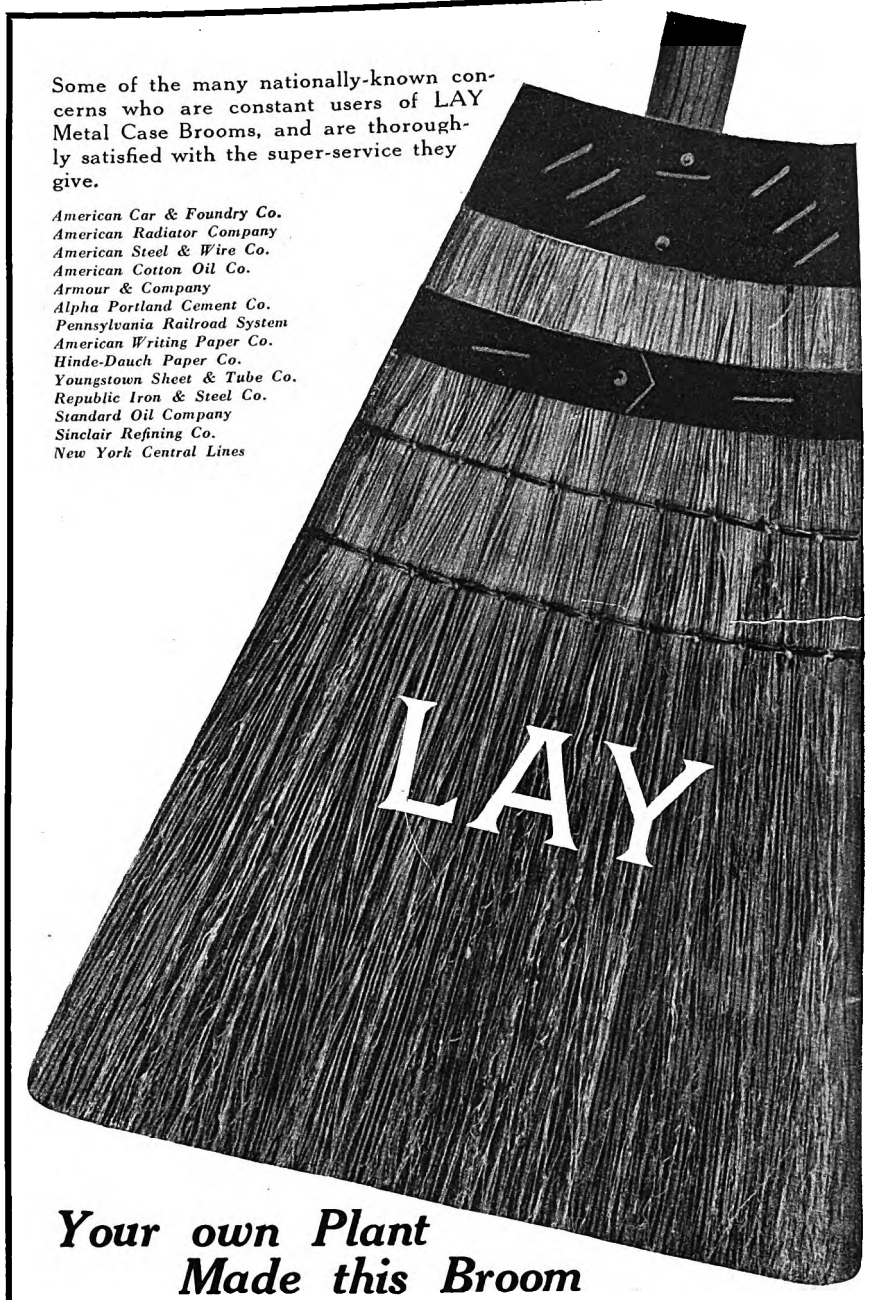
The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories, and every line of industry.

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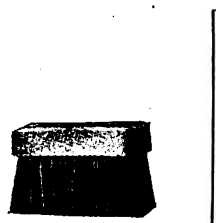
Your own Plant Made this Broom Possible

Forty-four years ago, the Joseph Lay Company established its policy of specialization—a special kind of broom for each type of factory. As each new industry appeared above the manufacturing horizon, its sweeping requirements were immediately investigated, and a broom perfected in our plant to serve it best and longest.

The extra-wide sweeping tip, the strong, durable construction, the stiff fibre center that can cut through any dirt, and the perfect balance, all combine to make Lay Metal Case Broom the most economical sweeping instrument.

Now is the time to order your 1924 supply. Send for a Lay sample to-day. Each one is fully guaranteed; we assume all risk.

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Steel wire
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We make also, a full line of industrial brushes—each one carrying the same unconditional guarantee of the brooms.





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Constant inspection during manufacture insures careful workmanship and the best of materials.

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Herein the Cowan Truck Company Presents the

If you study your cost figures and separate the time required for machine operations as against balance of time charged to the cost of that job, you will call for an accounting. The accounting will bring out this fact; time spent getting materials to and from operations, storage areas, etc. Analyze these statements and you will find Man-handling after Man-handling that *could* and *should be cut out*. It is at this point that the proper application of skid platforms and lift trucks will save you outgoing payroll money.

Increased production in itself does not reduce costs, but merely gives an inspiration which spurs the Management on to investigate labor saving devices. Many people today have reached the point

COWAN TRUCK COMPANY

HAND AND ELECTRIC LIFT TRUCKS
INDUSTRIAL TRUCKS AND TRACTORS

GENERAL OFFICE AND WORKS, HOLYOKE, MASS.

TO MEN CONNECTED WITH MANUFACTURING - WAREHOUSING - SHIPPING

The Cowan Truck Company as manufacturers of hand and electric lift trucks has, through its Engineers and the cooperation of its customers, designed lifting machines (or lirt trucks), which give the greatest flexibility or application and, therefore, the greatest amount of payroll saving.

All equipment is Guaranteed as to Materials and Workmanship; parts are Interchangeable and Accessible. Features such as Ease of operation, Convenient and Effective Oiling System, Accessibility, Long Life, and Adaptability to both Light and Excessive Loads, have all been incorporated in the design.

We call your attention to the following EXHIBITS which bring out REASONS why you should have COWAN EQUIPMENT.

EXH'T.1 : COWAN LONG LIFE SKIDS AND TOTE BOXES
Riveting feet to lower flange of angle in addition to bolting them to upper flange and decking gives greatest rigidity. Countersinking holes in decking for large diameter flat head bolts gives smooth deck. Spacing of runners gives guide for truck and centers load.

EXH'T.8&9: COWAN TYPE G HAND LIFT TRUCK
Easy lifting due to Cowan's patented lifting mechanism - Positive latch and easy kickoff through the use of Cowan's "off dead center" patent. Easy rolling due to proper bearings and Alemite greasing system. Lowering cushioned by means of approved check. Variety of standard sizes.

EXH'T.20 : COWAN MODEL LLT ELECTRIC LIFT TRUCK
Strength - Power - Simplicity - Capacity - Flexibility Ease of Control - Anti-kick Steer - Four Trucks in one: Lift truck, Load Carrying Truck, Pusher and Baby Tractor.

EXH'T.21 : FRAME FOR LLT DESIGNED FOR STRENGTH - Five Inch Channel, Bumper, protecting elevating platform, built into frame.

EXH'T.24 : COWAN MODEL LLT ELECTRIC TRUCK CHASSIS
Wiring system carefully laid out. Three point frame suspension. Crowbar method of lifting employed - most efficient of all methods. Bronze or steel bushings throughout. Alemite greasing system properly installed.

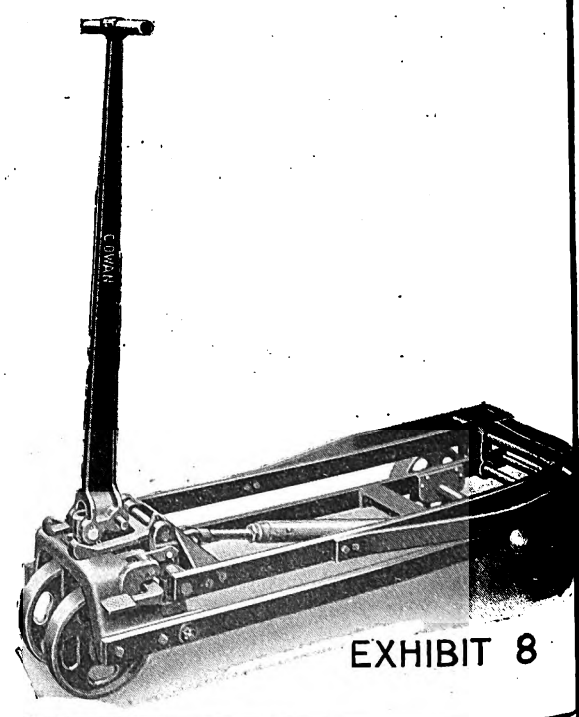
EXH'T.28 : COWAN LLT DRIVING UNIT
GENERAL ELECTRIC Motors - Over size brake - Automatic Control - Simplicity throughout - Mechanical and Electrical Accessibility.

These features put Cowan Equipment in a Class by itself. Cowan Trucks show absolute superiority in flexibility of application and ability to withstand service.

We will be glad to co-operate with you and will appreciate an opportunity.

Very truly yours,
COWAN TRUCK COMPANY
J. M. Eaton
GENERAL MANAGER





COWAN



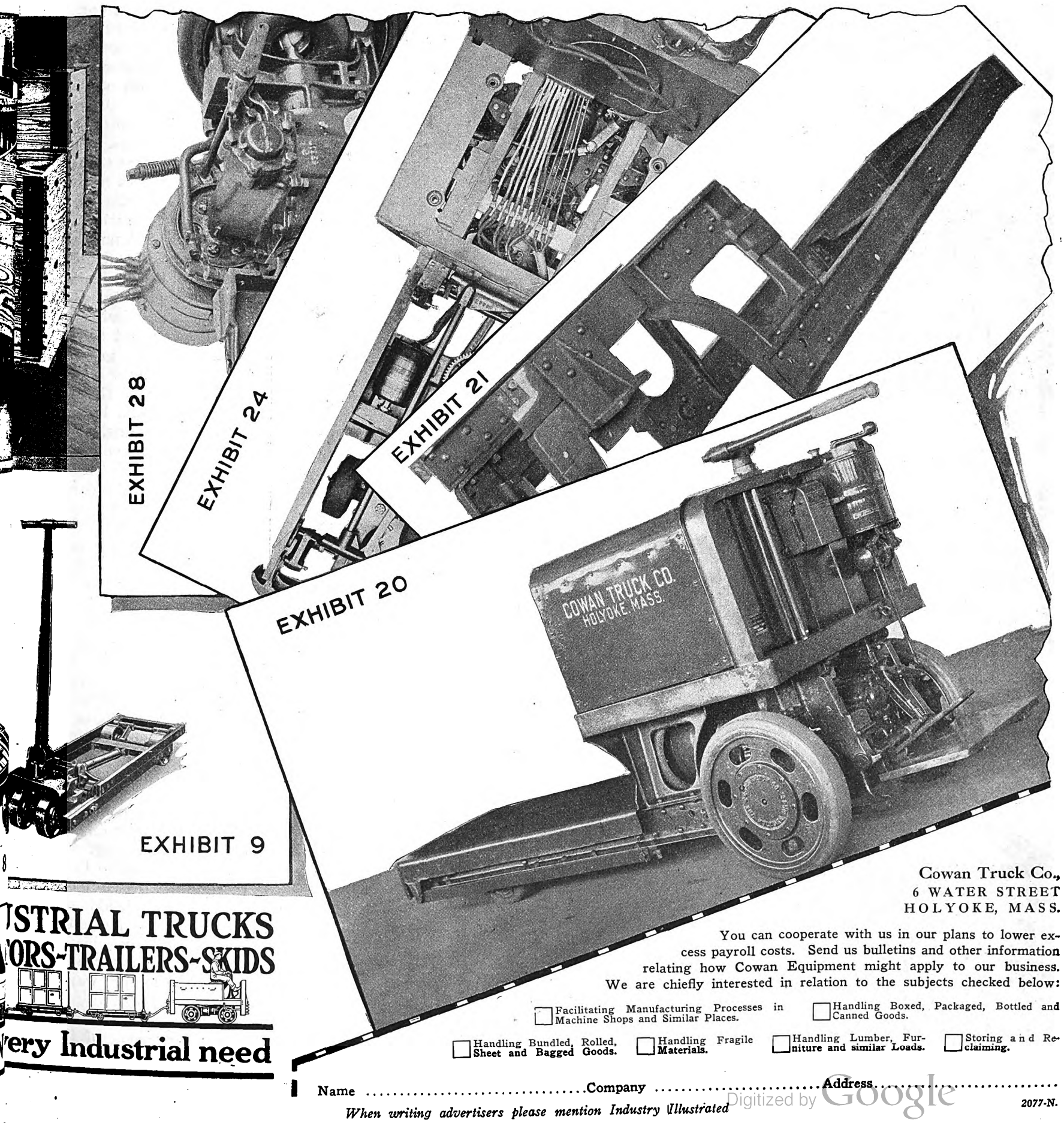
There's a COWAN U

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nts y With Which They Approach Your Problems

gains here there is no call for increased production, and yet these same companies have a very urgent unting all for increased profits. An opportunity for increased profits without increased production presents Ar self in the form of Cowan Lift Truck Equipment. This equipment if properly applied will eliminate ould Handling and Re-Handling and in turn will reduce your *payroll* by an amount equal to many times I saw he cost of Cowan equipment. A well known firm of Public Accountants has just figured out for one Company using Cowan Equipment that the payroll saving alone justified an expenditure for Cowan Equipment TEN (10) times as great as the actual amount spent. These figures are all certified spun nd authentic.
the

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STRIAL TRUCKS
ORS-TRAILERS-SKIDS

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You can cooperate with us in our plans to lower excess payroll costs. Send us bulletins and other information relating how Cowan Equipment might apply to our business. We are chiefly interested in relation to the subjects checked below:

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(*Continued from page 42*)

one process to another without lost motion, needless handling or delay till it reaches its finished state ready for the market. In the preparation for these processes of manufacture, a careful routing plan for the flow of materials throughout the plant should be made, the building designed to receive all of its machinery in its proper place, provision made for all bench work and special processes along the way, mechanical methods for handling and conveying things provided for, all railroad and truck service brought in at the right places, and the whole operation so arranged that the most effective supervision of the work and the most complete organization of the operating forces can be made.

In addition to providing for these processes of manufacture, there is nearly always the question of future growth and development to be taken care of in the plan and design of the plant. There is hardly any one who builds that does not expect to increase his business in the future. If one were to attempt t provide space at first for com plete expansion, the unuse space would add unnecessaril to the overhead and carryin charges; so the thing to do is t provide all along the line fo future growth by adding to th building in the future. Some times this is a most difficul problem and requires a grea deal of study.

In laying out the floor pla for present needs, it frequentl happens that some part of th building needed now may cu off the possibility of future ex tension, or something may ge in the way of future growth Then again should be avoide if possible, the gaining of futur space by adding stories above as this involves the moving o elevator pent houses and othe mechanical things. It is bette to build the plant the full heigh as far as it goes if this can b managed. Usually the best wa is to lay out the whole plant fo the complete future expansio as far as possible and then wor backward, by elimination to th part of the plant to be built firs

To plan and design the build ing so as to best suit all thes conditions is the great problem The manufacturer knows his re quirements and the result h wishes to attain, but unless h is a skilled designer and planne of buildings, he cannot possibl make a plan and design for hi building that will secure for hi all the advantages and econo mies in production which h should have if he is going to en ter this new competition whic will come through the perfectio and development of industria buildings.

For the building to serve t its greatest capacity in the in dustries, the whole question o its design and construction ma be concerned, such as its foun dations, column spacing, floors windows, overhead lighting, ar tificial light, elevators, convey ors, walls, partitions, type o construction and in fact, every thing that goes to make up th completed building. There i always a choice to be made o these things, based upon experi ence, which should select th best one for the purpose in hand or it is quite possible that spe cial constructions in some case would be the only way to serv best the purpose.

When it comes to the planning and arrangement of the build ing, what a great opportunit

(*Continued on page 48*)



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There is a Stuebing Lift Truck for every interior hauling need

Without doubt, the main attribute of Stuebing leadership is the ability quickly to analyze your material handling problems, and furnish a type of lift truck which completely meets your need.

Narrow aisles and congested quarters are obstacles which the Single *Side* Lift Stuebing—*a new model*—is specifically designed to overcome.

Do you load freight cars or move heavy loads up inclines and over crossings? For this we furnish the Stuebing Easy *High* Lift—a multiple lift with side action.

You may have unusually heavy or bulky loads to move. For this purpose we build the Stuebing *Heavy Duty* Truck or the Lift Truck Trailer.

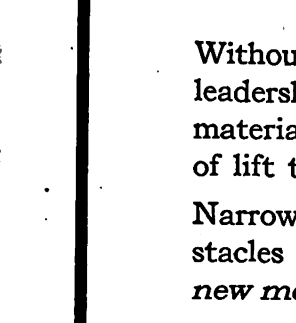
Very likely, however, your trucking requirements are not unlike those in a thousand other plants wherein production schedules are met with a type of Stuebing Truck that for ten long years has held the leadership in sales over any other type or make.

Until you investigate it you do not know how closely the Stuebing System fits your need for *efficient*, *inexpensive*, *safe* and *quick* movement of materials.

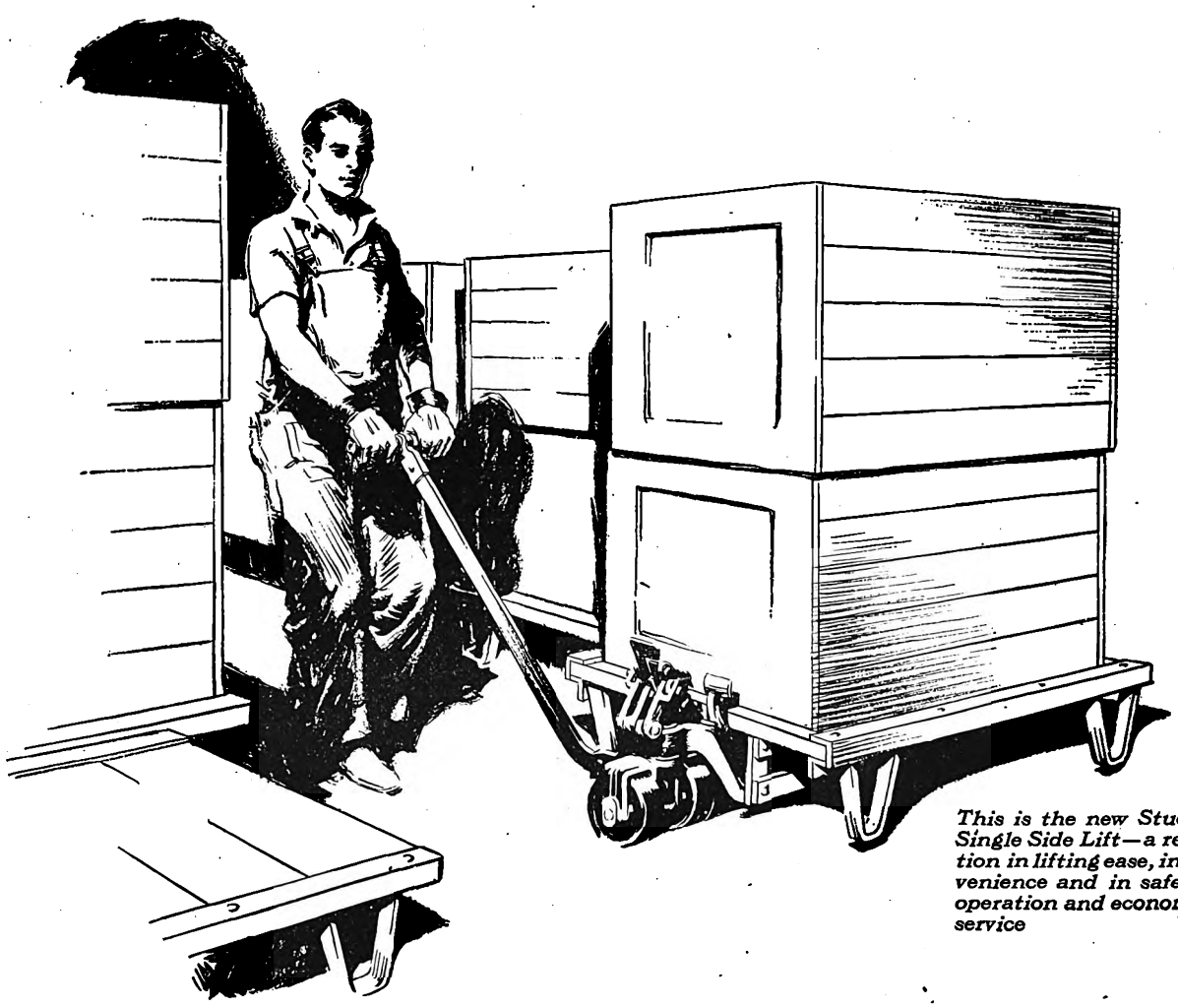
After you have had a demonstration of a Stuebing Truck—and see how nicely it meets your conditions—you will use no other.

Phone or write our nearest representative, who will show you a model; or write us direct for our new 36-page catalog, a complete handbook of material handling equipment.

THE STUEBING TRUCK COMPANY
Cincinnati, Ohio Montreal, Quebec
Branch Sales Offices in all Principal Cities



STEEL WHEELS ARE STANDARD with Stuebings, for no other but steel wheels can assure the long lifetime of trouble-free service required of a Stuebing. Chilled wheels (standard with lift truck makers generally) can be had if preferred. All wheels are Hyatt-equipped



This is the new Stuebing Single Side Lift—a revelation in lifting ease, in convenience and in safety of operation and economy of service

StueBing

LIFT TRUCK SYSTEMS

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NO OTHER LIFT TRUCK IS BUILT LIKE A STUEBING!

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(*Continued from page 46*)

there is to attain results that the inexperienced planner would never dream of! How often has an important plant been built from the first or second sketch of a draughtsman or a man who makes machinery, without even trying to apply the many different layouts or arrangements that might solve the problem better than the one adopted. A man who is skilled in planning would usually make many plans for an important plant, until he had drawn out every feasible way in which the building could be arranged.

This is the only way by which all the good features can be revealed for consideration and study. By a process of elimination and selection, a composite plan in this way can be built up that will have advantages and sometimes features of great value that could never come from an unstudied plan or layout of an inexperienced man.

The making of these plans, if properly done, should carry along with it the forming or moulding of the elevations, or exterior design of the building, at the same time, as the exterior of any building should always express truly its plan and arrangement, and they should always be developed together.

The reason that so much emphasis is laid upon the making of the plans is that comparatively few people realize that the planning and designing of a building can only be done properly by persons who have had a long training and preparation for this work. In studying the plan and design for a building, it is the faculty of the imagination which is brought into play to invent, create and suggest to the mind the various solutions for the problem, and it is for the mind or reason to select and apply the best of these solutions to the problem. If the mind is not stored with knowledge of this subject and if the imagination is not specially trained in this work, the result cannot be anything but that of a novice; and yet many plans for buildings which are full of lost opportunities are constantly executed and thereby irrevocably transformed into brick and mortar.

Another way in which the building affects production is through the employees. It goes without saying that a man is more likely to do his best work in a perfect workshop. The greatest possible incentive to secure faithful, conscientious and efficient work is to arouse an interest in the work for the workman, and plan and equip the building and its surroundings so that they are well suited for the work, complete in their provisions for the daily life of the workman and at the same time just as attractive and pleasing as it is possible within a reasonable expense to make them.

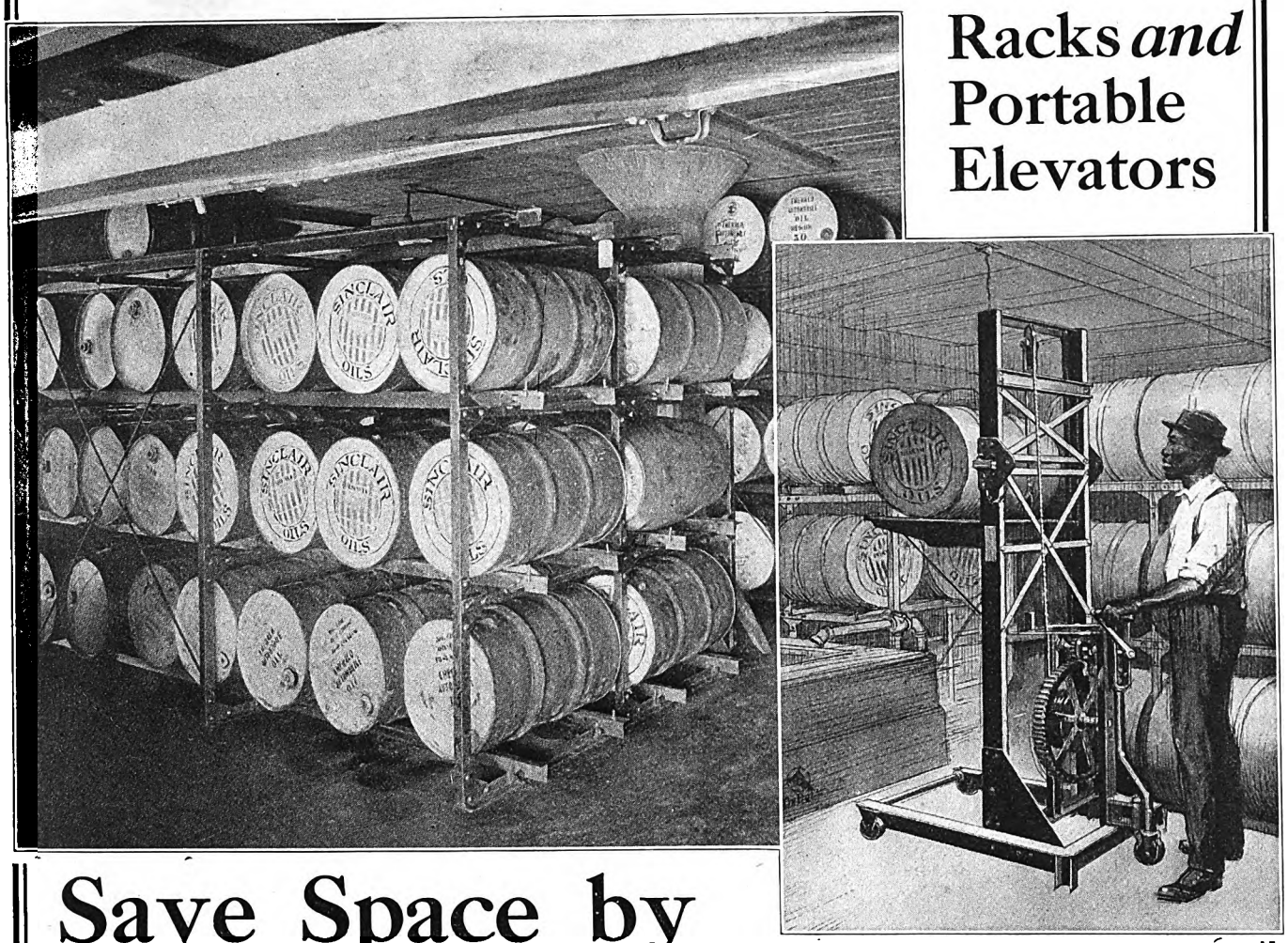
If it be true that the annual loss to manufacturers is anything like what it is reported to be, and if it be true that attractive, efficient industrial plants equipped for the average welfare work reduce materially the turnover of labor, then it would really be economy for every manufacturer to go the limit in this direction and make his plant a model in every respect.

According to the authorities who have gathered abundant statistics to prove their statements, the turnover of labor or "the hiring and firing of employees" for the years in which the records were taken, reach

(*Continued on page 50*)

ECONOMY SYSTEM *of* STORAGE HANDLING

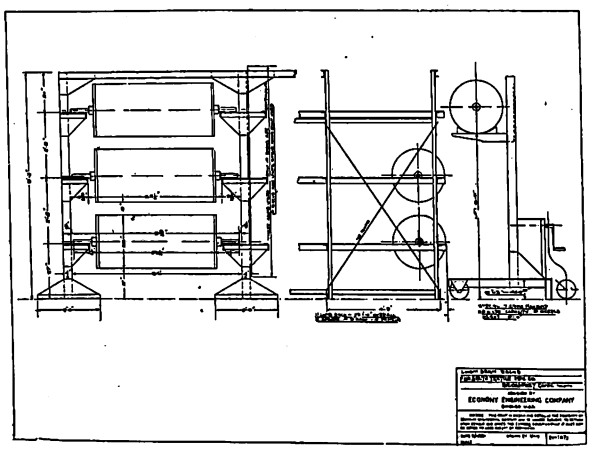
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Save Space by Using Economy Racks

Portable Elevators

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Plain or Telescoping
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Racks for

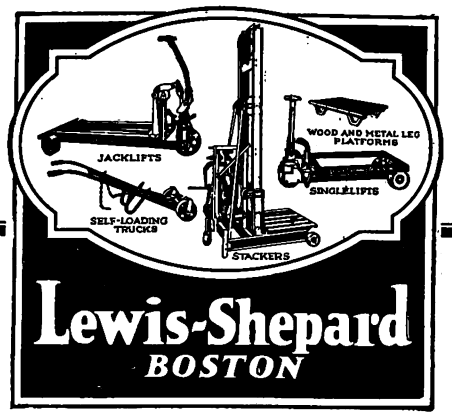
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An Illustrious Family of Labor-Saving Products

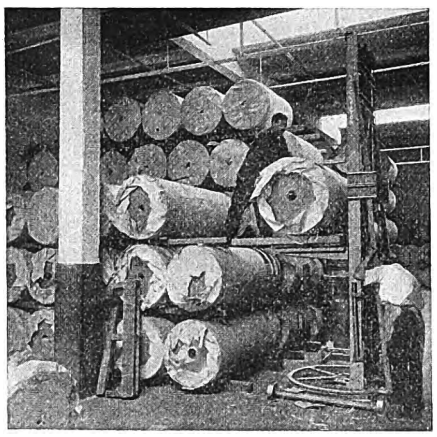


OVER 5,000 business firms show handsome yearly profits on L-S products. 600 per cent is the experience of average users. Multiple uses are discovered almost daily for saving labor, time, space and money in your particular line of business.

Our catalogue covers 32 major lines of business which L-S Products serve. Our detailed up-to-date data include over 150 lines of business. We guarantee results with every installation. TODAY'S Correspondence is the best **Short Route.**

Lewis-Shepard Co.

582 East First Street, Boston, Mass.



DON'T USE LABOR ALONE TO PILE GOODS—USE THE REVOLVATOR.

The Revolvator line of portable elevators or piling machines covers every situation where goods are piled in warehouses or stock rooms. Revolvators are made in nine standard models—hand operated, motor-driven and combination hand or motor operated, all with either revolvable, non-revolvable or open end bases. When necessary special machines can be built to handle unusual piling conditions. Revolvators are sturdily constructed, easily operated whether elevating or lowering material and for rapidity and economy in piling goods show wonderful results. They will handle material up to 4000 pounds in weight.

Send for Bulletin E-60 *and secure further details. Write today.*

Portable Elevators Lift Trucks Barrel Racks

REVOLVATOR CO.

311 Garfield Ave., Jersey City, N. J.

Indicating **Tycos** Temperature Instruments Controlling Recording

YOUR CHOICE

?

Which one or ones of these catalogs will you have? 26 catalogs that cover every industrial temperature need.

You never can tell just when you will need a temperature instrument but it will pay you to specify *Tycos* when you do.

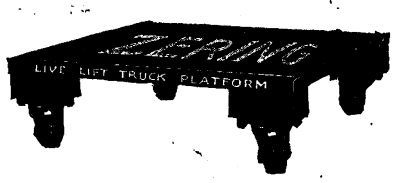
If by any chance you cannot find what you desire in this list or you want specific information, a letter will bring it.

Please send the Catalogs checked below to:
Firm .....
City ..... State .....

Part 1 —Instruments for Steam-Power Plants.
Part 100 —Industrial Thermometers, Temperature Control.
Part 200 —Instruments for Sugar-Manufacturing Plants.
Part 300 —Instruments for Refrigerating and Cold Storage Plants.
Part 500 —Instruments for the Food-Preserving Industries.
Part 500A—Instruments for the Milk Industry.
Part 500B—Instruments for Condensed-Milk, Evaporated-Milk, and Dry-Milk Processes.
Part 600 —Instruments for Gas Plants.
Part 700 —Instruments for Varnish Making, Oil Boiling, Asphalt Melting, etc.
Part 700A—Instruments for Oil Tempering, Metal Baths, Tempering Ovens, etc.
Part 800 —Instruments for Enclosed Spaces, Air Ducts, Ovens, Kilns, etc.
Part 900 —Instruments for Bakers and Confectioners.
Part 1300 —Hygrometers.
Part 1400 —Engraved Thermometers.
Part 1500 —Hydrometers.
Part 1700 —Instruments for the Oil Industry.
Part 4000 —Radiation, Thermoelectric and Optical Pyrometers.
Part 8000 —Recording and Index Thermometers.
Part 11850 —Electric Contact-Type Temperature Controls.
Part 15000 —Singl-Duty Temperature Regulators.
Part 15150 —Dubl-Duty Temperature Regulators.
Part 15300 —Thermo-Tyme Temperature Regulators.
Part 15700 —Self-Acting Temperature Regulators.
Part 16100 —Pressure Regulators.
Part 17000 —Type-P (Rigid-Stem) Temperature Regulators.
Part 18000 —Accessories for Temperature and Pressure Regulators.
Signed .....

Use your pocket knife or shears. If they are not handy tear out the whole page. But do it today.

Taylor Instrument Companies
Rochester, N. Y., U. S. A.
Canadian Plant, 110-112 Church St., *Tycos* Bldg., Toronto.
There's a *Tycos* or *Taylor* temperature instrument for every purpose.



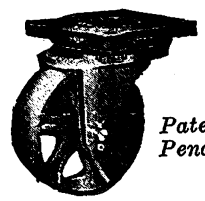
Move this Platform Where You Please

"Dead" Platforms mean dead loss in valuable time. In crowded aisles, in the stockroom and upon the shipping floor they are always in the way—slowing down production and offering an opportunity for idling till a lift truck can be found.

Zering Live Platforms

Move on ball bearing, swivel casters without the aid of a lift truck. Short hauls of raw materials or finished products are accomplished without loss of time. Fewer trucks and fewer hands are necessary with ZERING LIVE PLATFORM equipment. Confusion is avoided. Quicker, smoother factory operation is the result—often at a saving of from 10% to 50% in trucking costs.

ZERING LIVE PLATFORMS are sturdily built to stand abuse—in styles and sizes to suit every trucking need. Their low cost makes them doubly economical.



Patent Pending

Champion Adjustable Double Race Casters

These patented double race casters are standard equipment upon all ZERING LIVE PLATFORMS. They are trouble-proof, practically wear-proof, quick-acting and make heavy loads seem light. All wear in the ball races is taken up by an adjustable nut. Casters need not be removed from truck.

THE H. ZERING MFG. COMPANY

4425 Enyart St., Oakley Station,
Cincinnati, Ohio

Manufacturers of Trucks, Trailers, Casters and Skids

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(*Continued from page* 48)

the most astonishing figures. They assert that the average concern "hires and fires" as many employees every year as it carries on its payroll, and that the average cost to replace a workman is $50.00. So that if a man had 1,000 employees, he would have to hire 1,000 new employees every year to keep the number up to the thousand mark and it would cost him $50,000 annually.

If the same loss from labor turnover is going on now throughout the country, the total annual loss, assuming that there are 8,000,000 industrial workers, would be the colossal sum of $400,000,000!

The remedy for excessive labor turnover is unique compared with other losses. It cannot be cured by the enforcement of any set rules, as a man always has the right to quit his job and he can usually get the same wages by going to some other plant. The remedy, therefore, must be something which will appeal to him and which he will voluntarily accept.

The most reasonable and natural way seems to be to make the plant attractive to him and as complete for his comfort, convenience and general welfare as is possible to do.

Some records have been made of the effect upon employees of the attractiveness of a plant and its provisions for welfare work among the employees, and the results obtained have shown a marked decrease in labor turnover and an increased spirit of loyalty and coöperation among the employees. In fact, the best evidence of its success is the fact that those who have tried it are well satisfied with their results and could not be induced to conduct their business on any other basis.

The cost of those plants which have attractive buildings and surroundings may appear to the uninformed as being excessive, and yet as a matter of fact, the difference between the ugliest box of a building and one which is architecturally attractive and sometimes beautiful and also equipped for the chief welfare work, has been found by actual experience to be only from two to three per cent. of the total cost.

The industrial building usually offers one of the best opportunities for securing attractive architectural effects at a reasonable cost. This is true on account of the chance to mould into attractive forms the many different shapes and kinds of shops and parts of buildings which go to make up the industrial plant, the opportunity often afforded of making a beautiful tower out of the sprinkler and water tanks, and the fact that it is often possible to set the building back sufficiently from the lot lines to break up the monotonous long walls with pavilions, gables or projections, and best of all, the opportunity to do a little planting of trees and flowers in the foreground of the building or at some place which will give a touch of beauty and attractiveness to the plant which could not be secured by any other means.

In the onrush and struggle for supremacy among the American industries, there could be no finer record left to posterity by the people of our times than for the competition among them to turn towards the betterment and improvement of their plants along these lines. There is no question but that all concerned would benefit thereby.

Keeping in Step with Progress

The demands of present day boiler room operation, with the higher steam pressures, superheat and higher temperatures have resulted in the New Troy engine—a worthy addition to the regular Troy line.

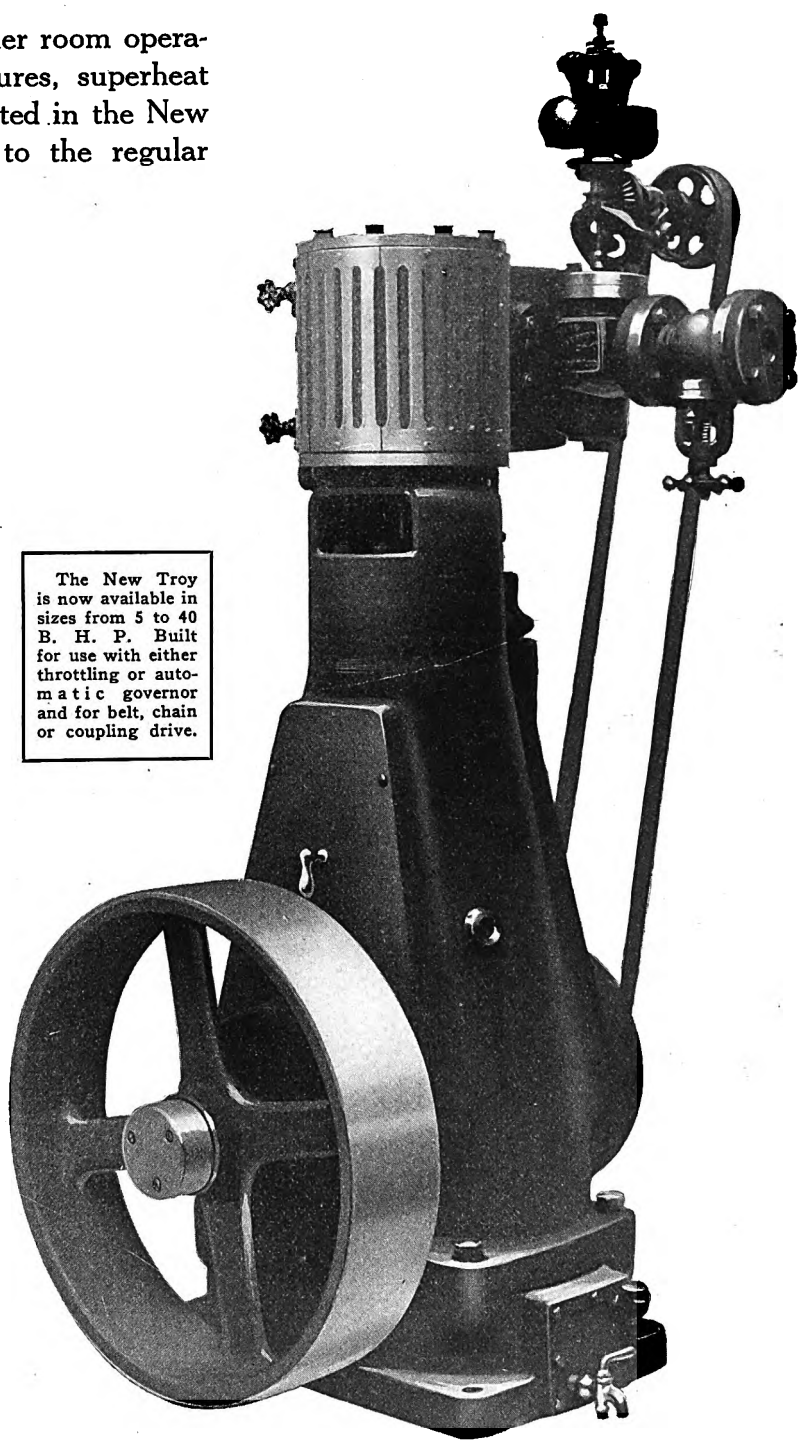
The New Troy is especially adapted to drive modern stokers. It is of extra heavy construction with large overload capacity to overcome resistance offered by stiff stoker shaft bearings in starting. The New Troy meets every demand for greater power in the smallest space possible.

It is of heavy design, fully enclosed and carefully balanced. It is dust proof and, of course, is designed with the Troy system of lubrication which supplies each bearing with an abundant supply of lubricant. The number of parts subject to wear and replacement has been greatly minimized.

Troy Engines have long been known as the most dependable steam units for driving fans, blowers, compressors, pumps and generators; for stoker operation and also for main power purposes.

Send for the Troy Catalog

Troy Engine & Machine Co.,
TROY, PA.



The New Troy is now available in sizes from 5 to 40 B. H. P. Built for use with either throttling or automatic governor and for belt, chain or coupling drive.

Built in Sizes From 2 to 200 B.H.P.

ONLY STEAM ENGINES GOOD ENGINES ONLY

TROY ENGINES

ONLY STEAM ENGINES GOOD ENGINES ONLY

DEPENDABLE POWER with ABSOLUTE SAFETY

When writing advertisers please mention Industry Illustrated

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Shop Courtesy

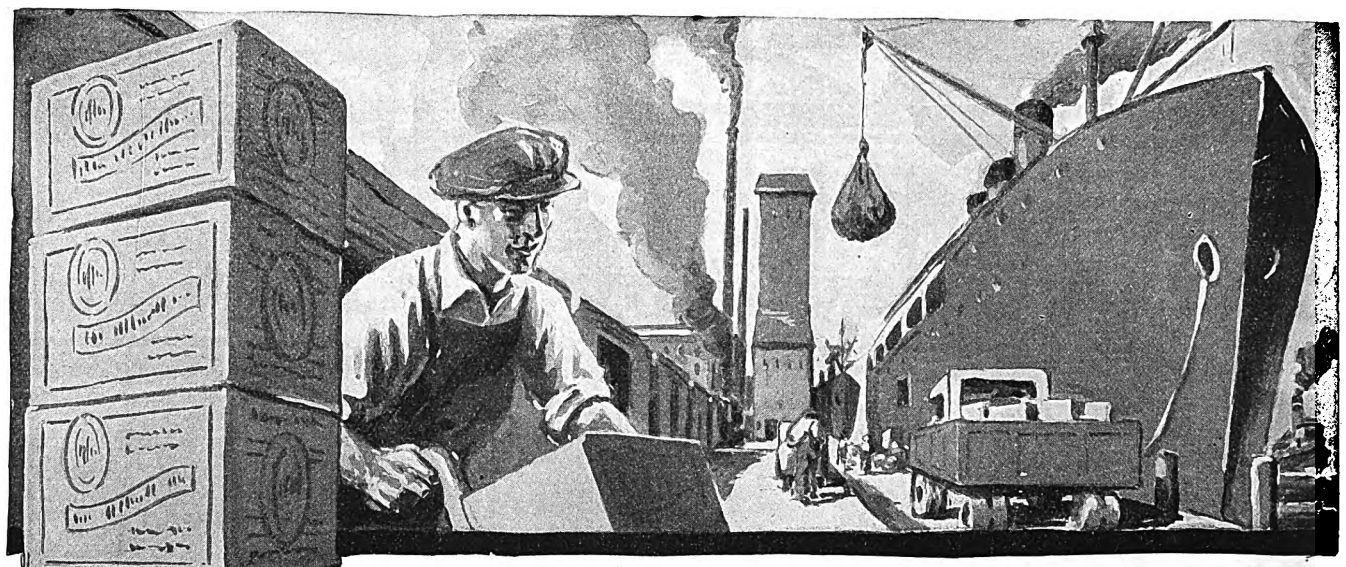
By O. C. Richards

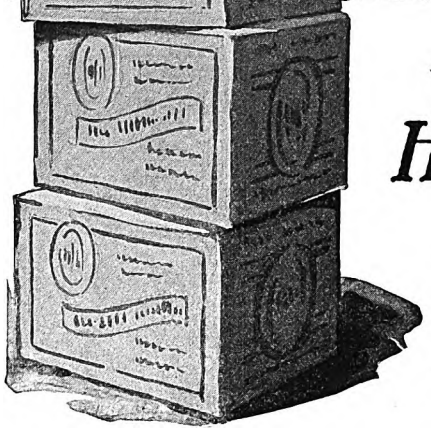
MANY people greatly undervalue courtesy about the shop. The man who known among his social acaintances, as a most agreeble gentleman, is often a conmed grouch with his business sociates. In the average facry, mutual courtesy among the orkmen is one of the biggest ctors in keeping down the bor turnover, and makes the ace attractive to old and new lp alike. When new people re hired, they naturally feel ore or less lost at first in the ew surroundings. Girls who ve never worked in such a ace before, are particularly t to take a dislike to the shop, they are not made to feel at me. Both men and women ten form cliques and somemes attempt to freeze out new mers. I have seen this in a mber of instances and have und it a very difficult situation handle.

Among the old employees, ere are always some who are selfish that their associates nd them a constant source f unpleasantness. Whenever ese men are asked to give a ft they are busy, whenever me one has to obtain material r the common use of the roup, they always try to dodge. hese people would be surprised know how much they have wered themselves in the estiation of their fellows.

The workman has it in his ower to make life pleasant or ery disagreeable to his foreman. The habitual grouch does ot known how to be courteous, nd it does not take many such o take the joy out of life for he foreman. Such a man is ever ready to do any little xtra task or assist his superior n any way he can avoid. The ther day I saw an excellent exmple of courtesy. A new man ad misunderstood his instrucions and was not willing to heed he suggestions of the experinced men near him. One of the en hunted up the foreman and xplained the situation. It preented spoiled work and gave hat foreman the feeling that he ad friends who wished him uccess.

It is very difficult to so assign ork as to give each workman n even chance to earn, and there are men who are always complaining of the jobs they get. At one time, in a department of which I had charge, jobs were lined up on a production board in the order in which they were to be given out. It became a habit with several men to plan the finish of their job, or rather their trip to the desk for the next assignment, so as to avoid any undesirable job they saw on the board. This selfishness and lack of consideration for others made it necessary to turn the





why more than forty million H&D Boxes were used last year.

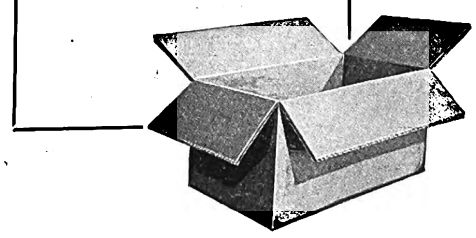
At busy depots—on wharves and shipping platforms—in spacious warehouses—in speeding express trains—on lumbering motor trucks—wherever there is merchandise going to market, you will find these clean-looking, sturdy H & D Shipping Boxes in surprising numbers.

Their known ability to deliver merchandise intact always, their adaptability to widely varied packing requirements, their low cost, their advertising value, their sales helpfulness, their unequalled all-round fitness to carry everything from fine glassware to rubber boots—has made them the most practical and widely used of all containers.

The H & D Box Catalog should be in your purchasing department's hands. A reference to it before ordering your next lot of boxes may suggest some economies over your present packing methods that will surprise you.

Sent upon request.

The H & D Package Planning Department has developed some of the most successful containers in use today. It will design for you—free of all charge—a box that will exactly fit your goods and carry them most economically. Just send us a sample shipment—for repacking and return.



The Hinde & Dauch Paper Company

299 Water Street **Sandusky, Ohio**

Canadian Address: Toronto—King St. Subway and Hanna Ave.

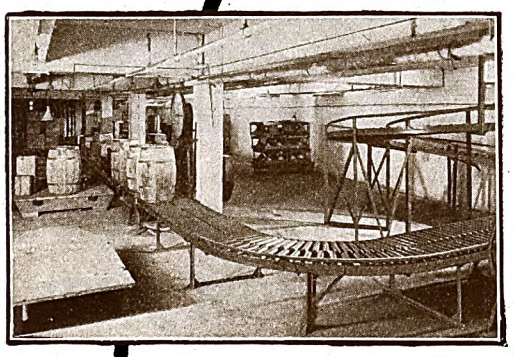
The World's Largest Manufacturers of Corrugated Fibre Boxes and Packing Materials

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backs of the orders out so that there could be no picking.

Courteous foremen are not nearly so common as we might expect. Some foremen think that they do not have to be civil to those under their charge, since they have the authority to order them about. Such men have the old school idea. The progressive man realizes that it is an art to direct others and that requests are far better than arbitrary orders. It does not lower prestige to be courteous, in fact the consistently courteous foreman is apt to be highly esteemed. The Vice-President of a large manufacturing concern is a very quiet man, and is noted for his polite manner. One of his immediate subordinates was telling me, at one time, how effective the quiet questioning of this man was when someone had been lax in his duty and had to be reprimanded. The narrator had recently been on the carpet before this Vice-President and had come out of the private office with increased respect and admiration for his superior.

Save Labor!
Let Gravity do your Lugging



Eight Trucks Unloaded in Two Hours

Nothing unusual — just a regular performance. There were five truck loads of nails and three truck loads of miscellaneous wholesale hardware items. Two truckmen outside and three men inside put these five loads into storage in record time —*but*, they had a

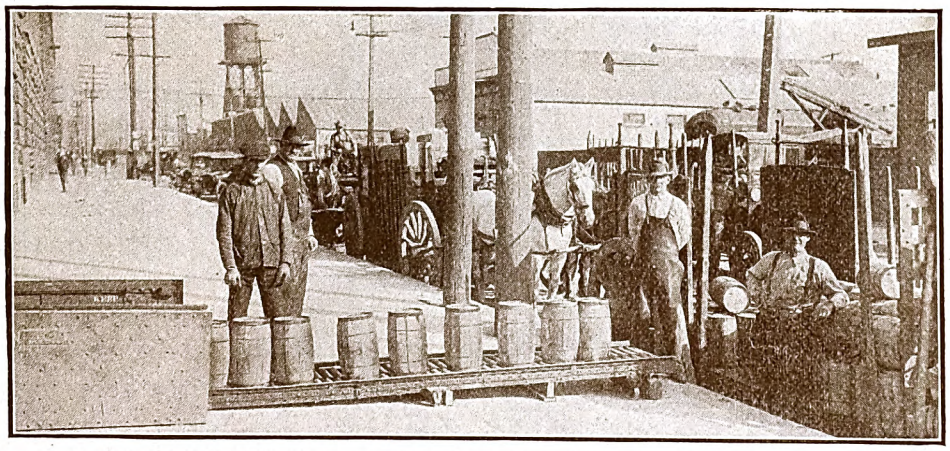


Mathews Gravity Conveying System

to help them. That accounts for their fast work. The illustrations show three views of the conveying system which we installed for the Baker, Hamilton & Pacific Co., San Francisco. In this system the famous Mathews Double-Roller Gravity Conveyers are employed in both spiral and straight runs. This type permits the handling of a great variety of merchandise packages.

Come to Package-Handling Headquarters

for expert advice and free engineering service. We maintain branch offices in all principal cities. Catalog on request.



MATHEWS GRAVITY CARRIER Co
·102·Tenth·Street ~ ELLWOOD CITY·PA·
Branch Factories: Port Hope, Ontario - London, England

MATHEWS
SPEED GRAVITY ROLLER ECONOMY CONVEYER

Foremen and others in a sho often find that they have to dea with those who are more or les on an equality with them, s that it is neither a case of orde or obey orders. Courtesy is a invaluable asset in such in stances. Some men are neve able to obtain what they wan under these circumstances with out resorting to a great deal o trouble and possibly unneces sary red tape. I was once talk ing to the foreman of the main tenance department, in the plan where I was employed, when h said to me, "Here comes Wil liams. He will tell a funny stor and then get whatever he is after." Here was an instance where courtesy and good nature helped a man to get coöperation from his associates. Such co operation is invaluable an often means the difference be tween success and failure to th individual.

Courtesy as a fundamenta policy of a business firm, bot to outsiders and between th members of its own organiza tion, is about the most valu able principle I can conceive o A consistent preaching of suc an idea will result in not onl a successful, but a happy an contented organization. It is t be hoped that we will have a increased amount of attentio paid to shop courtesy.

The novel suggestion that a motor gasoline be colored red a a safety measure designed t guard against its being mistake for water, kerosene, or othe colorless liquid products, is ad vanced by W. A. Jacobs, chem ical engineer, Department of th Interior, who has been detailed by the Bureau of Mines to make a special study of the hazards o gasoline.

The use of the color red is con sidered almost universally as a indication of danger, Mr. Jacob points out. On the railroads i shows the engineer that th track is not clear, in blasting operations it warns people o possible danger; traffic officers use it as an indicator that traf fic is halted; and in some states all gasoline sold must be dis pensed in containers painted red

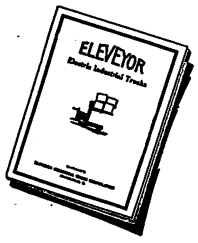
Gasoline is often mistake for water, kerosene, or some other colorless liquid, and, judg ing from various newspaper re ports, this mistake often results in explosions and fires, and sometimes in loss of life.

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ELEVEYOR



The ELEVEYOR (3 Trucks in 1) Saves 66⅔% in Handling Costs at this Plant



Write for Catalog

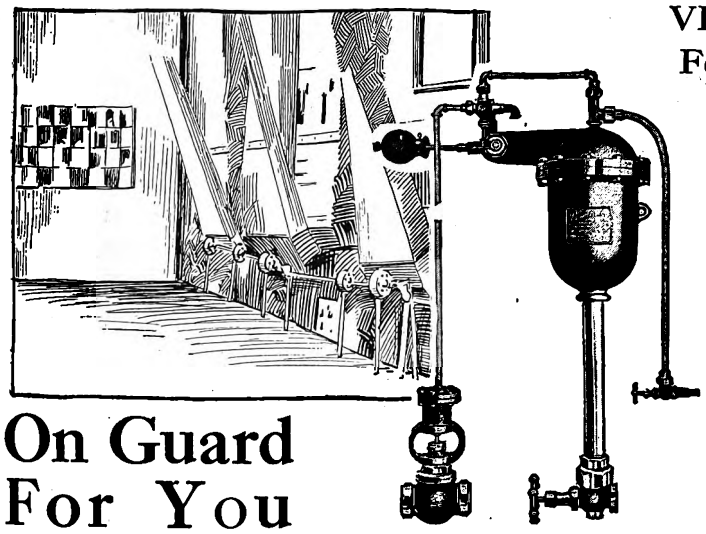
Here is another example of how the ELEVEYOR —the Truck that conveys, elevates and stacks material—saves in handling and storing costs.

In this plant (name on request) the ELEVEYOR has not only effected savings in the storing of raw materials, but has actually cut handling costs 66 2/3%.

We have a practical plan whereby we can prove the economy of ELEVEYOR Trucks, right in your own plant. Let us tell you about it.

ELEVEYOR INDUSTRIAL TRUCK CORP.

56 Huntington Street Brooklyn, N. Y.



VIGILANT Feed Water Regulator

On Guard For You

The necessity for the maintenance of a steady, constant water level at all times can best be realized by those plant managers whose every endeavor is devoted to economical and efficient operation. They quickly appreciate the value of insuring the proper water levels without having to depend upon the uncertain human factor.

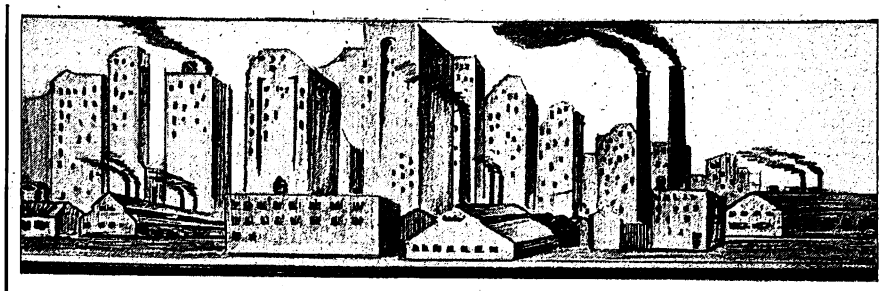
The Vigilant Feed Water Regulator is truly "on guard for you" at all times. It automatically fixes your water level; it prevents explosions; it conserves fuel; it guarantees maximum operating efficiency. Its use will eliminate your boiler room worries to a great extent.

For 25 years the Vigilant has been the premier Feed Water Regulator. It is entirely gravity operated; it has no floats, diaphragms or tubes; it is a steady, reliable worker.

Let our engineers make recommendations for you—without obligation.

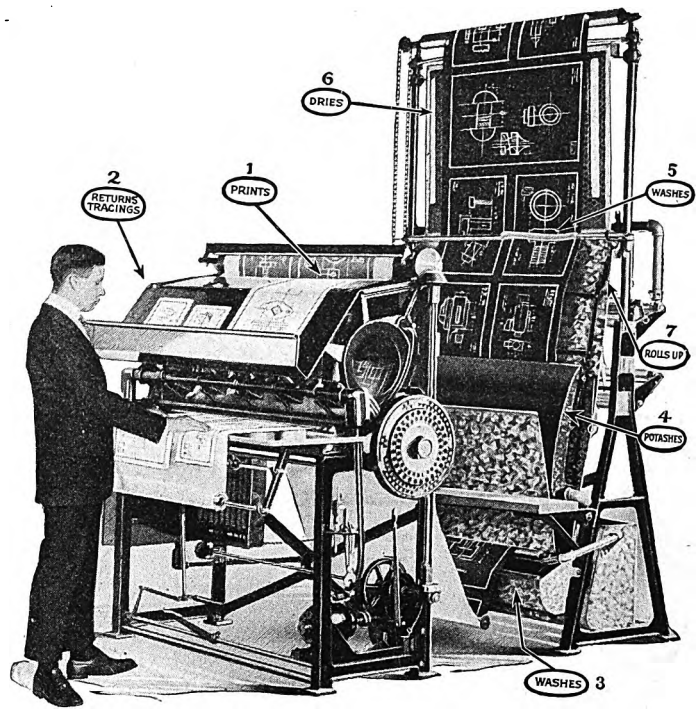
The Chaplin Fulton Mfg. Co.

28-36 Penn Avenue,
Pittsburgh, Pa.



Big Business and Small

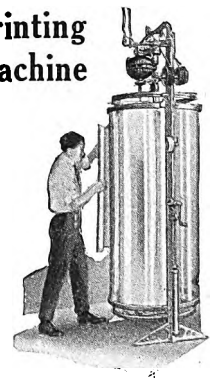
--Users of Pease Blue Print Equipment



Among prominent users of Pease Blue Printing Equipment are The American Locomotive Works, Schenectady, N. Y., Western Electric Co., Chicago, Ill., Union Tool Co., Barber-Coleman Company.

Users whose requirements do not anywhere approach those of the above companies are purchasing Peerless Equipments because we have proven that the Peerless is the most economical blue printing machine whether it be operated for as short a run as 5 yards or for its capacity of 120 linear yards per hour.

The Pease Vertical Blue Printing Machine



For use in Plants where Requirements are smaller

The Peerless requires only one operator, and in many cases the machine is run at stated intervals during the day. The operator can thus clear up in a short time work that would require all day by any other method.

In fact, the Peerless Equipment turns out blue prints at one-quarter the cost of any other equipment using independent methods of washing and drying.

Catalog M-23 tells the whole story. It will be gladly sent on request without obligation.

THE C. F. PEASE COMPANY

819 N. Franklin St., Chicago, Ill.

PEASE CHICAGO

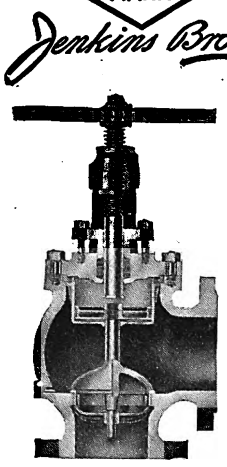
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Made for maximum service not merely the average

TRADE JENKINS MARK

Jenkins Bros

Automatic Stop and Check Valve —for Boiler Efficiency and Safety



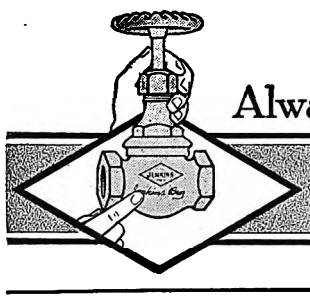
Sectional View, Fig. 293, angle, Extra Heavy Iron Body Automatic Equalizing Stop and Check Valve. Sometimes known as "Non-Return" Valve. Made also in cast steel.

THIS valve opens by the pressure inside the boiler to which it is attached, making it impossible to accidentally turn steam into a boiler which is being cleaned. It also automatically cuts in newly-fired boiler when the proper steam pressure is reached. When the boiler is in operation, should internal rupture occur, the valve closes. The valve also equalizes the pressure between boilers operating in a battery.

Valves in bronze, iron, and steel for all requirements.

JENKINS BROS.

80 White Street .....New York, N. Y.
524 Atlantic Avenue .....Boston, Mass.
133 No. Seventh Street .....Philadelphia, Pa.
646 Washington Boulevard .....Chicago, Ill.

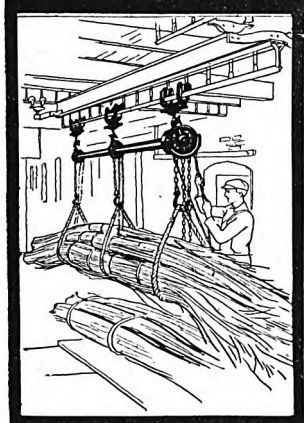


Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

WRIGHT HOIST



ARE you conserving Time—Energy and Costs in your Hoisting Operations?

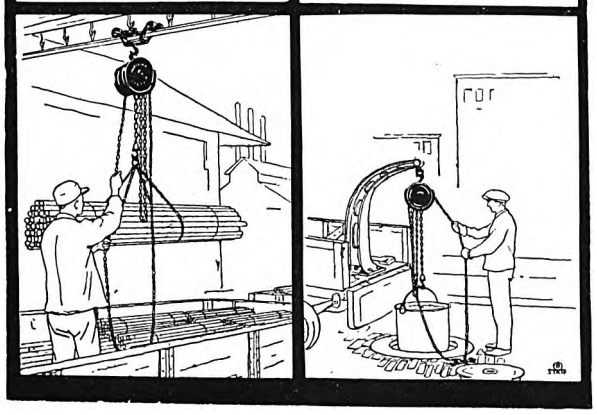
Wright Hoists are built to accomplish these results.

May we tell you how ruggedly they are built?

What's your name and address?

WRIGHT MANUFACTURING COMPANY

LISBON, OHIO



Putting Self-Respect on the Payroll

By LYLE E. DIX

IT is a man's self-respect that makes him most valuable to his employer. It is the satisfaction of doing something useful that incites a workman to put his best effort into his work.

This feature of profit is much overlooked in industry. Putting a man in a treadmill will force him to keep up his end but it will certainly not hold him on the job.

Of course treadmill talent will always be worked in the treadways of employment but the big part of the matter lies in the ability of the executive to discriminate to his advantage.

A gang of pick-and-shovel men were interrogated by a member of the company for which they were leveling off a piece of ground. Some members of the gang were slowly and indifferently throwing a shovelful of dirt now and then while others stood, between shovelfuls, and looked around, viewing the landscape and talking.

The member of the company was a student of efficiency. He inquired of the diggers in a friendly manner:

"What are you fellows building there?"

The reply was: "I dunno."

"Why are you leveling off this ground?" and he looked in vain for an intelligent answer.

This man went immediately to his office and sent for the overseer who was handling the workmen.

"What are you doing with that gang of diggers?" he inquired of the overseer.

"Getting the ground in shape for the foundation," said the man in charge of the crew of workmen.

"What foundations?"

"The foundation for the fire apparatus building."

"How do you know that it is for the fire apparatus building?" asked the executive.

"Because the foreman told me and I saw the blueprints," replied the overseer.

"What is the fire apparatus building for?" asked the employer.

"It is for storing the fire carts, hose, ladders and safety equipment in a handy place."

"Why do we need fire carts, ladders and safety equipment?"

"So we can fight and prevent fires and save men's lives."

"Exactly," said the manager. "Now I want you to go out there where your men are leveling off that strip of land and tell them what they are doing, Mr. —. Tell them that on that site we are going to erect one of the most important buildings in this plant.

"Put this information over to them so as to give them a part in the building of this plant. If possible, give one or more of them a specific portion of the job. Explain to those men that this is one of the most significant jobs on the works. Tell them what they are making and why they are making it. Do this offhand, not dictatorially. Do it like you were interested and like you felt that they were also interested."

Soon after the overseer left the office, the manager looked out over the great yard and plant and, as his eyes wandered to the site for the new fire apparatus building, he saw shovelfuls of dirt flying—men were spitting on their hands and tieing into the work of constructing something. Their desire to create had found its release for the while, in the erection of an important building for the purpose of fighting fire and saving men's lives in the plant where they earned their living. Their self-respect was sustained by the wholesome reaction of the kind of work they were doing and the way in which they were doing it. They were not simply leveling off a piece of land with no apparent object in view. They were making something.

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The Passing of the Dinner Pail

By Maxwell Droke

SOMEWHAT less than a generation ago, the full dinner pail was a universal mbol of American prosperity. most all factory workmen, d many office and shop em- oyees as well, carried to their ily labor a two quart lard icket, filled with somewhat ggy provender, against the vages of noon-time hunger.

Today the dinner pail is al- ost as extinct as the Dodo, hatever that is. Nobody car- es 'em anymore. The doom of e dinner pail was sealed with e coming of the cafeteria.

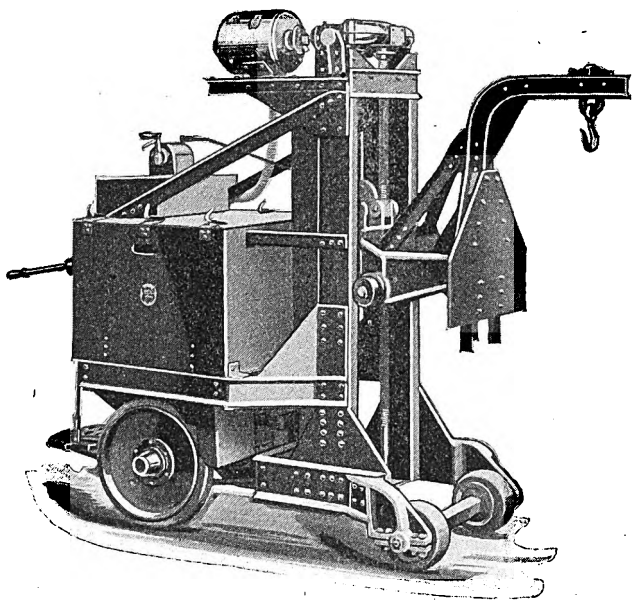
The employee lunch room or feteria is so comparatively cent an innovation that no ery definite standards of prac- ce have as yet been worked t for its inauguration and aintenance. But from this atement do not take a broad anding jump to the wrong nclusion. The industrial cafe- ria is not an untried theory. has long since passed the xperimental stage. There are any things we must yet deter- ine concerning the industrial afeteria. But there is one thing e no longer have to guess about -and that is whether or not it a worthwhile institution.

The industrial cafeteria as we now it today is not the result f over-night growth. It has ad a steady, step-by-step de- elopment to its present state f maturity. The earliest fac- ory restaurants were an out- rowth of the idea, in a few nstitutions, of serving the orkman free coffee or milk to upplement his cold dinner-pail enu. So favorably was this lan received that it was not ong before the factories were erving soup and crackers. In ome instances this latter addi- ion was served without cost; n other cases a charge averag- ng about five cents per portion as made. From this point it as only a step to the full-meal ervice offered by most modern actory cafeterias.

The plant-restaurant idea is growing at such an amazing ace that it is scarcely practi- able even to hazard an intelli- ent guess as to the number of hese restaurants in successful peration. Figures become ob- olete before they find their way into print. As far back as 1917 the Bureau of Labor conducted a survey of 431 establishments, in a great variety of industries, for the purpose of determining, among other things, the provisions made for furnishing meals to the employees. It was ascertained that of the total number 224, or slightly more than 50 per cent, maintained lunch rooms. We can safely assume that, in the interval, the percentage has materially increased.

At the time this investigation was made it was found that the

The Latest Tier-Lift Development



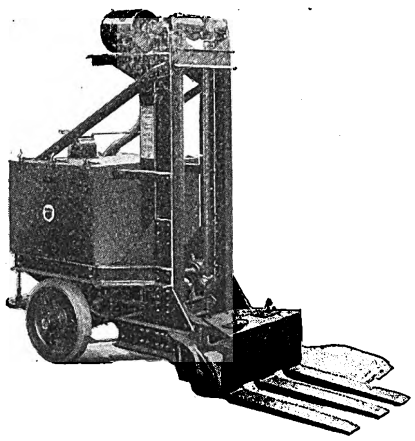
The crane attachment has a capacity of 2500 lbs. combined with a vertical lift as high as 80″. This has opened up new possibilities of application of the original "Tier-Lift" idea, which was brought out in 1919. The crane combines a carrying service and high lift—it already is in operation in an industry which previously was unable to apply electric trucks.—How can you use it?

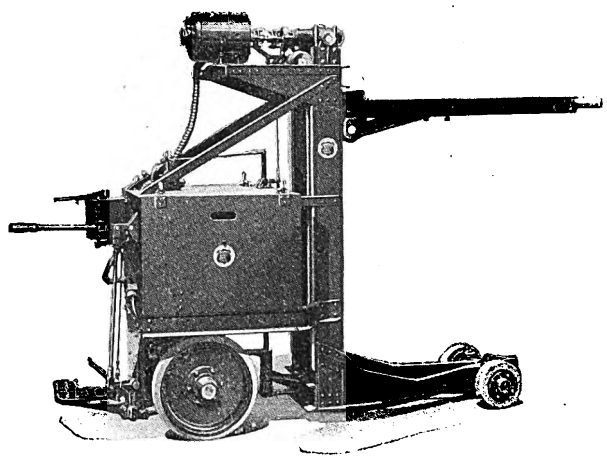
Below is shown the Fork Attachment on the "Tier-Lift" Truck, which has made possible the handling of loads without skids—substituting therefore two 2″ x 2″ strips. Products like tin plate, paper, bales, barrels, crates and boxes can be quickly and cheaply transported and piled.

The original "Tier-Lift" with its 4000 to 6000 lbs. capacity with lifts up to 96″ has made possible large savings. Its worth is emphasized by the many attempts to copy its valuable features.

The foregoing products are protected by Patent granted October 17th, 1922, and other applications pending.

We shall be glad to supply you with further information and catalogs.





The Lakewood Engineering Co.

Cleveland, Ohio

Originators and Patentees of the "Tier-Lift"

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lunch rooms were divided almost equally into two classes—those with waiters, and those affording cafeteria service. It is only fair to point out, however, that the growing popularity of the cafeteria in recent years is resulting in a steadily increasing percentage of lunch rooms of this latter type. As a rule they may be more economically operated than the waiter-service type, thus resulting in lower-priced food. And price is a paramount factor in the successful operation of an industrial lunch room.

With very few exceptions the factory lunch room is either owned by the company, or by the employees themselves. Probably less than 10 per cent. of these lunch rooms are conducted by outside management, and the percentage is steadily decreasing. Inasmuch as this is essentially a company welfare enterprise, a large number of concerns prefer to keep the management under organization supervision.

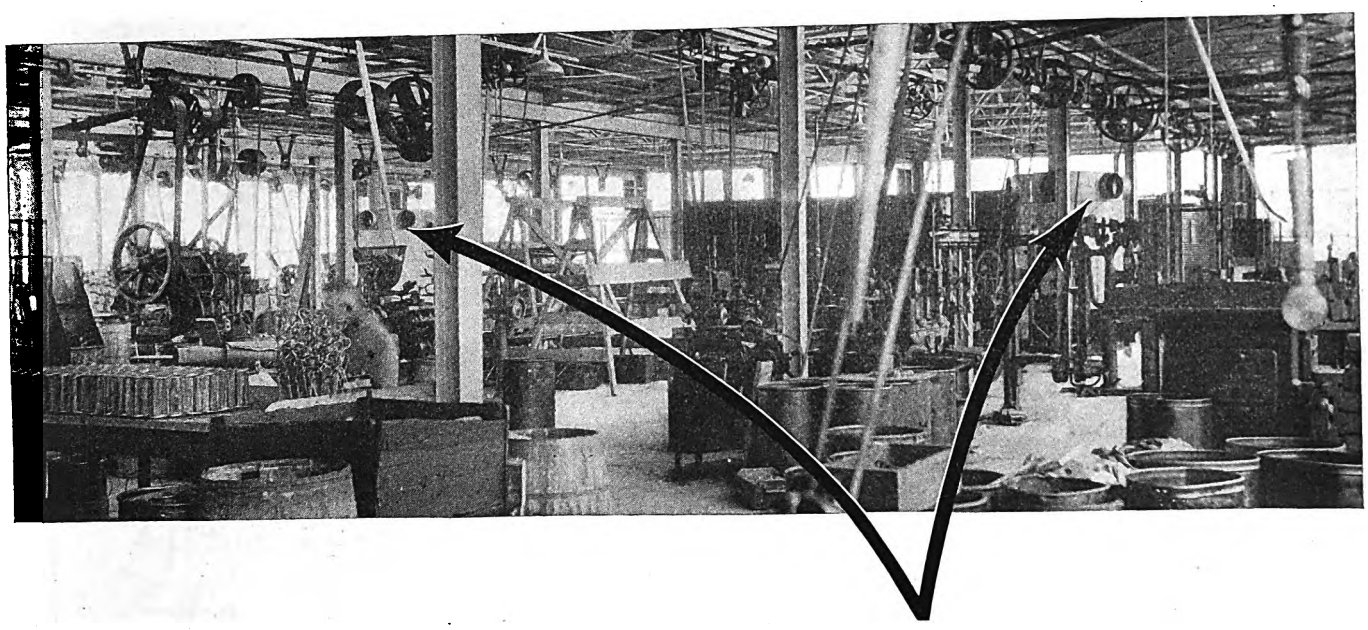
Of the employee-owned lunch rooms, probably the plan followed by L. S. Ayres & Company, the great Indianapolis department store, is fairly typical. In launching this innovation, the company first called a meeting of all department heads for the purpose of presenting the idea. The executives were asked to appoint certain members of their departments to serve on an employees' committee, for the purpose of making the necessary plans.

To this committee the company made the following proposition. We will provide the necessary space for a cafeteria-type lunch room, and furnish light and heat free of cost. Moreover, we will lend you $1500.00 with which to purchase necessary equipment and make a start. This is all we can do for you. From this point on it is necessary for you to work out your own salvation and put the lunch room on a sound financial basis.

It took the committee exactly one year to pay back the $1500.00 which the company advanced, and they have finished each year since that time with approximately the same amount on the right side of the ledger. This in view of the fact that the lunch room is not operated primarily for profit, and food is served at prices much lower than average restaurant quotations.

The Ayres lunch room opens for business at 10:45 a. m. and serves lunches until 2 p. m. Upon occasions they also serve evening meals to those employees who are putting in overtime. The restaurant is patronized regularly by more than 70 per cent. of the employees. In this way the workers come to know each other better, and a wholesome spirit of good-fellowship prevails.

Within a few months the Ayres employee-owned lunch room will celebrate its seventh anniversary. From the worker's standpoint it has been an unquestioned success. The company, too, is well satisfied. Frederic M. Ayres, president of the institution, said recently: "The restaurant has done more than any one factor to keep our workers contented. *And it has eliminated costly tardiness at noon.* Before we started the restaurant, many of our employees endeavored to go home at noon for a warm meal, with the result that they drifted back perhaps half an hour late. Now they do not have to leave the building



"WE HAVE SEVERAL OF THESE FURNACES

in operation during the winter season and assure you that they offer excellent heating service. We have burned wood, soft coal, and coke in these furnaces with satisfactory results."

This statement, written by a Wisconsin foundryman, is like many others in our files. His satisfaction is due to these definite reasons:

1. Costs less to install than indirect heating systems and uses up to 50% less fuel.
2. Direct-fired. Burns economically either hard or soft coal, coke, oil, or gas.
3. Keeps the heat in circulation near the floor instead of allowing it to waste upward.
4. Simple construction. Ordinary mechanic and helper can assemble it in a few hours.
5. Can be operated by anyone who can swing a shovel. Does not require the attention of a skilled engineer or boiler-man.
6. No steam or drip pipes to worry about. Nothing to freeze up.
7. Extended surface fins on the fire pot and the thin rings on the tubes provide a maximum heat radiating surface.
8. Over-all efficiency is 81% by official test in the laboratory of the Armour Institute of Technology. More than double that of any other type of heater.
9. Recommended for drying clay products, asbestos, magnesia, tobacco, cereals, vegetables, textiles, and all other products dried by warm air up to a temperature of 400°.

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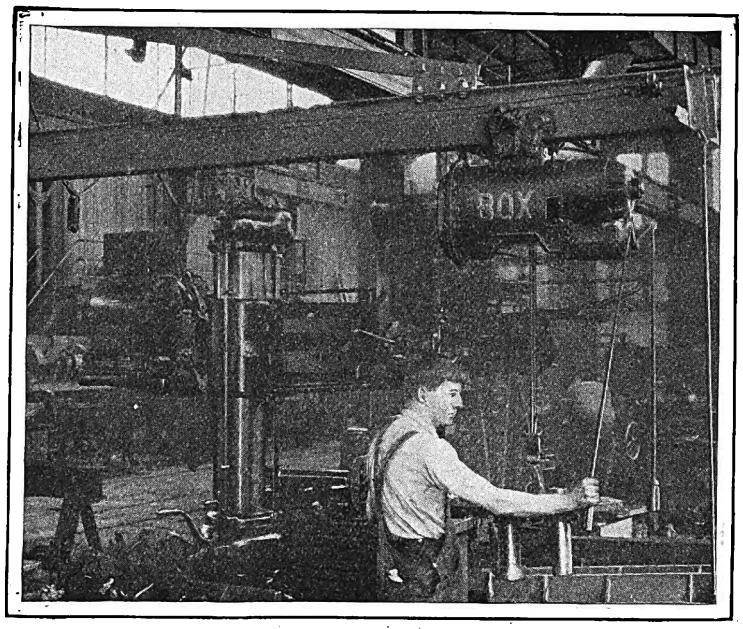
r lunch. They are better satfied, and so are we."

It is difficult to strike a eneral average in the prices harged at various employee nch rooms. Prices vary widely nder different conditions, and different parts of the country, e idea being always to serve od, wholesome food, at the west possible prices. Most of ese cafeterias now serve a andard table d'hote meal, comised of soup, meat, vegetables, ead and butter and dessert. he general run of prices is om 15 to 35 cents for the meal, ith a possible average of say cents. In addition to this andard meal, many of the resurants maintain a la carte rvice.

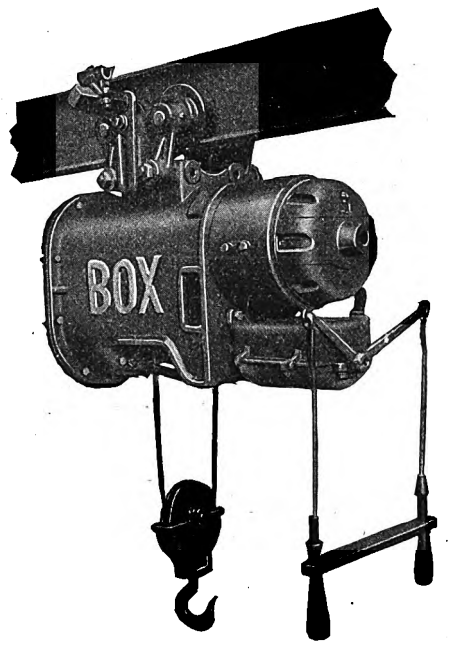
While these employee lunch ooms are not designed prirarily as money-making initutions, many of the well-anaged cafeterias do show fair ofits, even at the prevailing w prices. This usually is due the elimination of rent, light, eat and similar factors which, gether with overhead, comise a large part of the usual mmercial restaurant expense. is customary to give the emoyees the benefit of these resurant earnings. Usually the oney is turned over to the utual benefit association, the creation fund, or some similar ternal activity. I know of one se where funds from a resurant have been accumulating r more than five years. The nployees are planning to invest e money in a club house, which ill be located at a nearby reort. At this club the workers d members of their families ill be privileged to spend weekds and vacations.

In most cases, the lunchroom rivileges are restricted to emloyees of the factory, shop or ore. There are instances, howver, where a factory has exnded this service to include e workers in other nearby lants, thus reducing operating osts. And I know of one place, t least, where the general pubc is invited. The factory of e Steger Piano Company, at teger, Illinois, is located on a ell-traveled motor road. The ompany, by the use of attracve signs, extends an invitation the motorist to stop and dine the employees' cafeteria, conuding that the advertising thus ecured more than offsets the ossible loss entailed in serving ese outside guests.

In the matter of locating the cafeteria there is a general unanimity of opinion. A large majority of companies prefer to have it located in the main factory building, in as central a place as possible, so that employees will lose no time in going to and from lunch. Here again, however, I call to mind a notable exception. And that is the Columbian Rope Company, of Auburn, New York. Although the main plant of this company covers more than a million square feet of ground, in planning a cafeteria, the executives deliberately refused to consider a location in the plant itself, and erected a beautiful building across the street, to be used for this purpose. The company then went a step farther and issued a ruling which forbids any employee to eat his noonday meal within the shop. "We wanted them to get clear away from the place for awhile," one of the officers explained. "We felt that the morale and the health of the workers would be greatly improved if they broke the monotony of a day's work by a complete change of scene." The



LOAD LIFTER



WHEREVER efficiency, speed, steadiness and economy in lifting or shifting are needed, the "Load Lifter" is found. Their predominant use by the industries is well known. Their sturdy construction, ease of handling, low cost of operating and elimination of extra lifting squads show unmistakably in figures. The harder the work and the heavier the going, the more marked is the showing.

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Alfred Box & Company, Inc. have had a very broad experience in the problems of load lifting for both big and small concerns. They never urge an installation which does not promise a profit to the owner.

INVESTIGATE how the Load Lifter can be operated in your business—how it will cut costs and quicken production. Important data and Bulletins on the subject will be sent upon request. Ask your Secretary to send for it now.

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Working parts operated in bath of oil.
Positive Forced Feed Lubricating System reaching all points.
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Nothing to adjust.
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Extremely accessible.
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Every bolt a fitted bolt.
Fine workmanship throughout.

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Alfred Box & Co., Inc., are also builders of the "Box Crane"—a standardized, heavy duty, Electric Traveling Crane in capacities of twenty tons and under; also builders of hand operated Traveling and Jib Cranes of any capacity. In addition, full line of Electric Hoists to five tons capacity—embodied in which are all the important features found in the "Load Lifter."

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company is thoroughly satisfied with the way its plan is working out.

The size and equipment of a cafeteria depend, of course, almost entirely upon the number of employees to be served. In some very large plants a number of small lunch stands are operated. The United States Steel Company, for example, operates 73 lunch rooms at one of its plants. The Westinghouse Electric Manufacturing Company, on the other hand, restricts the food service at its great East Pittsburgh plant to a single building which has the distinction of being the largest eating place in the world for civilians. This three-story building seats 3200 persons at one time.

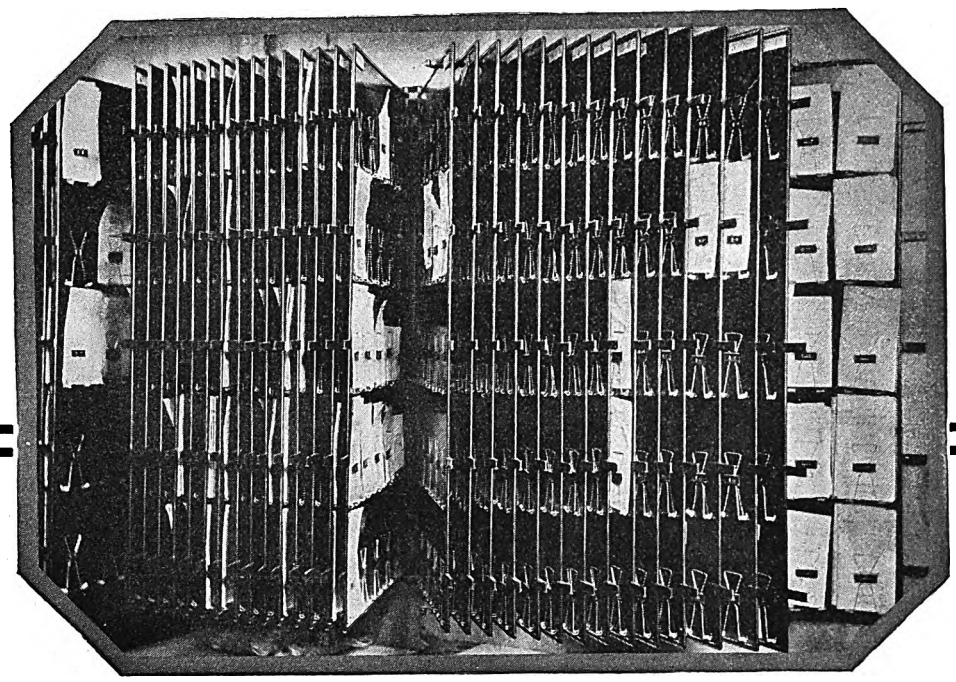
At the Westinghouse plant, by the way, there is an ingenious "speed up" device that has worked out very well, indeed. Moving belts are placed in front of the serving counters. Trays are placed on this belt instead of sliding them along the rail in the usual maddeningly deliberate way. It would be possible, of course, to hold the tray stationary and let the belt go its way, but the company finds that the general tendency of a diner is to keep pace with the moving belt.

The motorman in charge of this device says that he can accelerate the belt 25 per cent and rush the line through during busy periods. Thirty-four persons per minute can be served and this is perhaps 50 per cent faster than the average speed in cafeterias. At the Westinghouse lunch room, the average check for girls is 17 cents, while the men require 37 cents' worth of grub to appease the gnawing pangs of hunger. It should be pointed out, however, that many of the girls are office workers while a good percentage of the men are engaged in heavy manual labor.

A rather ingenious plan has been worked out by the Edward G. Budd Manufacturing Company. The company did not have space for a central lunch room so devised the plan of having a canteen on each floor. These canteens take up only about 60 square feet of space. The men stand in line and are served through a "cashier" cage door. In one of these canteens 250 men have been served in eight minutes. There are no tables, chairs or unoccupied floor space. The men take their food as it is handed out to them and eat at their workbenches, or elsewhere in the building.

The Budd plan, although successful, is not recommended for general adoption.

In physical appearance employee cafeterias range from barren, barn-like rooms, with rough wooden tables and benches, to the bright, cheery, tastefully decorated quarters which the telephone companies and other large employers of women almost always provide. Experience has proved conclusively that a little money spent in "fitting up" a lunch room is invariably a good investment. I recall the case of a department store in the Middle West that "anything will do" for the employees' lunch room. They took a depressingly dreary basement room, piled in a lot of cheap rough fixtures, and started in business. The result was that less than 10 per cent of the workers patronized the place. Later the store learned better, spent a few hundred dollars in beautifying the lunch room, and now a large majority of the employees eat there every day.

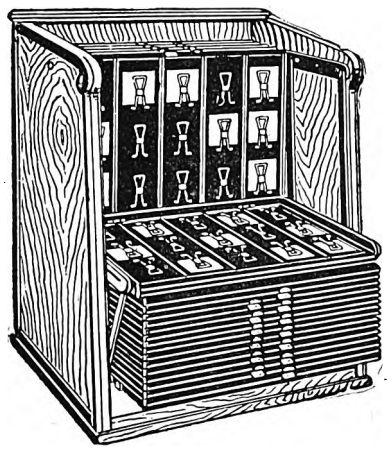


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You know how important deliveries are in keeping customers. You know how important it is to be able to promise delivery on a definite date and then to keep that promise. Yet how many firms can do it? One firm, Lipson and Adelson, manufacturers of Peggy Paige Clothing, has found a way. Mr. S. Frindel, Jr., Ass't. Sales Manager, says:

"Practically 100% on delivery promises is the outstanding result of our installation of McCaskey equipment. Particularly in our business which involves 16,000 classifications of dresses that must be handled in lots of one, two or three, proper production control here is no small matter. But the McCaskey has made it possible.



"We have 12 manufacturing departments in which production must be put through on schedule. When a cutting order is made out, it is filed in the McCaskey board together with the requisition for piece goods and trimmings according to the department which is to manufacture the order. As the piece goods and trimmings are delivered, they are checked off on the requisitions, and as the finished dress comes in from the department, it is checked off on the order.

"In this way, an indisputable aid is given us in following production in the different departments—and in insuring prompt deliveries to customers. After the cutting order is issued a tag is made out for the dress. This tag is in three parts, the first is attached to the dress, the second goes to the receiving department with the dress where it is detached and sent to the production control department, and the third is filed in the McCaskey when the tag was made out—and shows the scheduled delivery. A glance at the board shows which dresses are behind scheduled delivery.

"By means of the McCaskey we have kept production up to our ever increasing orders."

And in Your Plant---

You, too, no matter what your business may be, can have the benefit of an ever increasing number of satisfied customers by installing a McCaskey System designed for your needs. In hundreds of plants McCaskeys are keeping stock records, cost records and production records—are checking orders, keeping daily inventories and doing similar work. It is no trouble to find out what a McCaskey System will do in your business. Write us.

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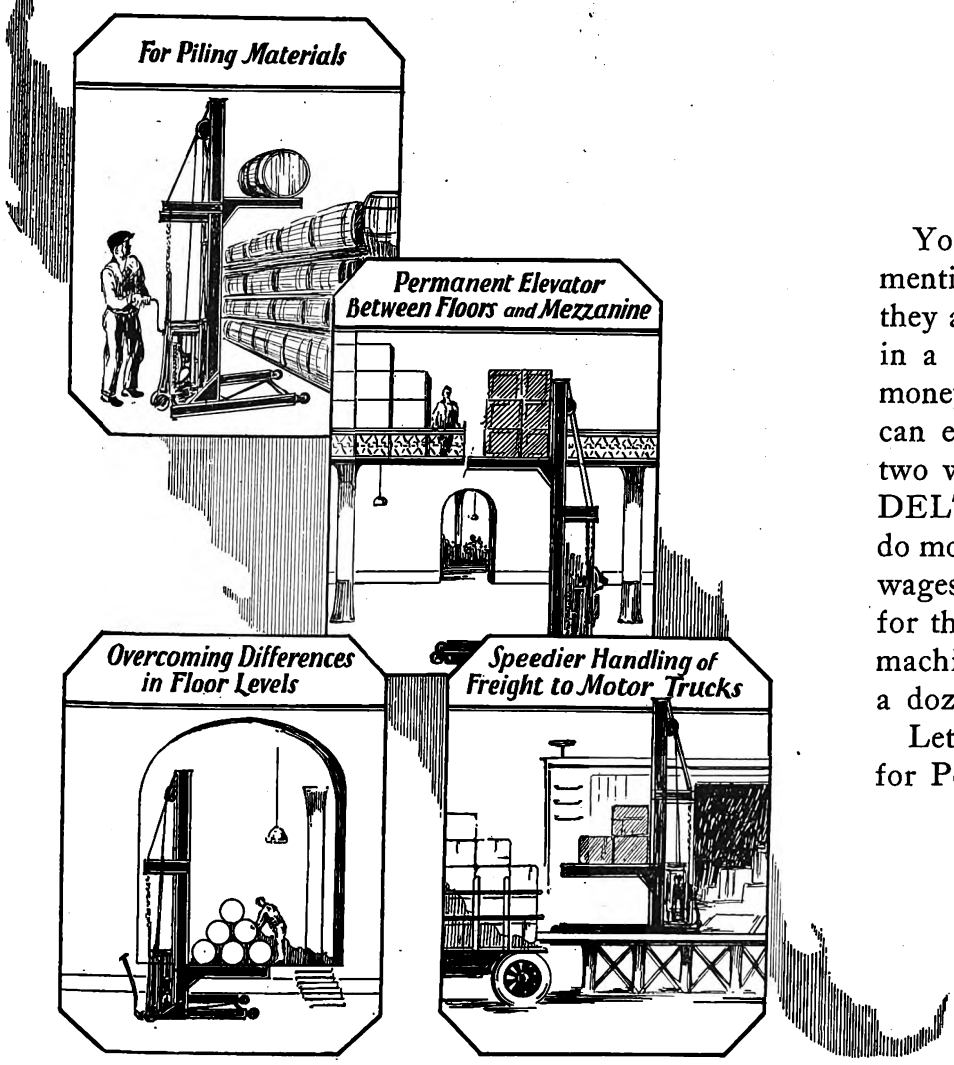
AUTOMATIC ELECTRIC BRAKE—locks when circuit is broken by controller, limits, low voltage or failure of current for any reason.

AUTOMATIC ELECTRIC UPPER AND LOWER LIMITS—that break the motor circuit locking the brake, when platform reaches high or low position.

REVERSING TYPE HOIST MOTOR—controls lowering speed.

SIMPLE OPEN ARRANGEMENT OF PARTS AND UNITS—no adjustments requiring mechanical knowledge.

TWIN DRUM, TWIN ROPE—eliminates side tipping of extra wide platforms.



You may have similar problems to those mentioned or described here, but whatever they are, we ask the opportunity to show you in a short time how a Delta can save your money. It is by far the cheapest labor you can employ. The wages paid one man for two weeks will pay for a small hand power DELTA. And with this one or two men can do more than three or four laborers. And the wages of one man for two months will pay for the largest standard size portable electric machine that will easily save the work of half a dozen men.

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Making Labor Appreciate the Labor-Saving Idea

(*Continued from page* 28)

burdensome tasks which are now being performed by the more ignorant classes of labor will be performed by machinery, and when the laboring man becomes fully acquainted with machinery and what it does for him he will refuse to accept a job unless machinery is provided to help him in the more difficult tasks.

Some of the more progressive industrial plants are beginning to realize that their best interests demand that they do more than equip their plants with labor saving machinery. They must also make an effort to sell the idea of the use of labor saving machinery to the men, convincing these men that machinery is not their enemy but their friend. If good, genuine, honest effort is made to get their men to look upon labor saving machinery in the proper light, a change in the attitude of the men will be noticed. The men themselves must be convinced that the labor saving machinery is a good thing for them before the owners and operators of industrial plants can expect to get all out of labor saving machinery that there is in it.

While visiting the plant of one of the largest wire mills in the country the writer was informed that the employees of this mill were demanding machinery to handle the 300-pound bundles of wire which have been handled for the past fifty years by manual labor. It has been the custom in this industry to require the men in the wire drawing departments to place a 300-pound bundle of wire on a reel and to remove it from the block after drawing without the aid of machinery. This operation required one man to lift a 300-pound load twice every minute for eight, ten and twelve hours per day without the aid of machinery of any kind.

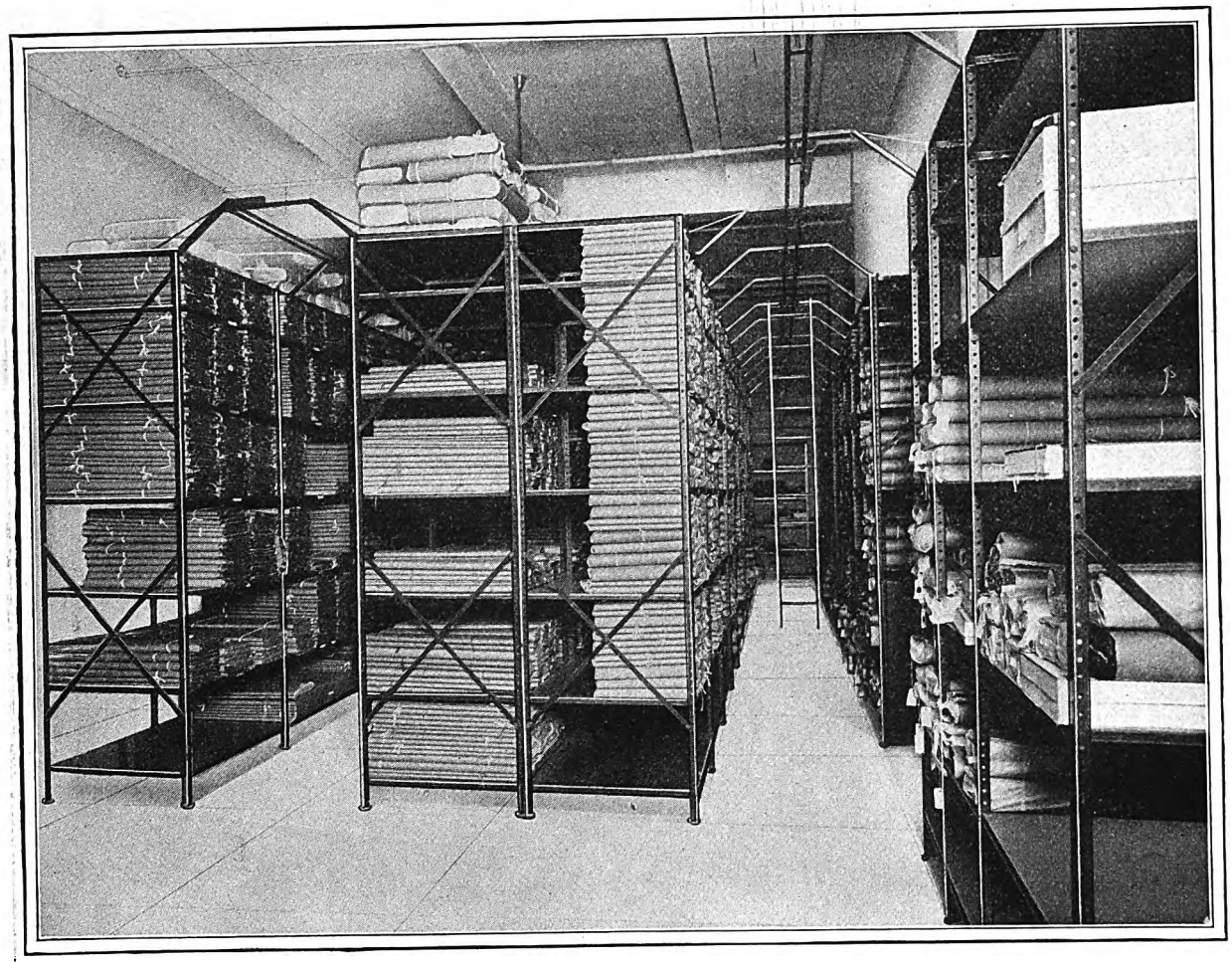
It is not long since the men in this industry objected strenuously to the use of any kind of labor saving machinery. They felt that the introduction of machinery meant the loss of their jobs.

As a contrast to the attitude of the men in the wire mill we hear of the stevedores at New Orleans going out on a strike as a protest against the use of an overhead Tramrail System designed to take a cargo directly from the cars and warehouses and lower it into the hold of boats. These men insisted upon the use of the more or less primitive method of hauling cargo with a ship's rig and dragging it by manual labor to its resting place in the hold of the boat.

A few years ago the construction of a large factory in Cleveland was tied up with a strike because the plumbers, steamfitters and electricians would not use a pipe cutting and threading machine that was provided by the owner of the building in order to get the building completed as soon as possible.

There can be no question but what it will be only a matter of time until these same unions and possibly these same men will demand a pipe cutting and threading machine on every large building. The cutting and threading of pipe is no easy task.

(*Continued on page* 62)



The Value of Standardized Shelving

The Joseph Berlinger Company, Silks, of New York City, needed storage facilities immediately. The present arrangement was only temporary because the stockroom was to be re-arranged in the near future.

The new layout of the stockroom would require an entirely different arrangement of the racks. The spacing of shelves and dividers would change. Additional parts would be needed.

Here was a case where the shelving installation must meet immediate requirements—and at the same time be adapted easily and quickly to future plans.

It is a splendid illustration of the value of standardized shelving.

Selection of Lyon Commercial Shelving followed naturally because all parts are standardized and interchangeable. It will be a simple matter for the Joseph Berlinger Company to adapt this shelving to the new arrangement of their stockroom. Orders for additional parts can be filled without delay from our warehouses at Aurora or New York City.

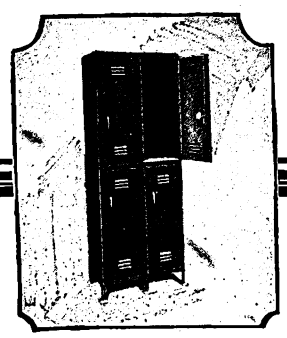
Applying Lyon products to our customers' needs as here—and building only the best products we can build have brought a high prestige to Lyon Steel Products.

Your stores problem may be needing a Lyon sales engineer. It costs you nothing to get his recommendation. He is capable of not merely recommending a particular shelving to you, but of laying out a complete storage plan for you.

Through him, our experience of years is at your service. Please address our main office.

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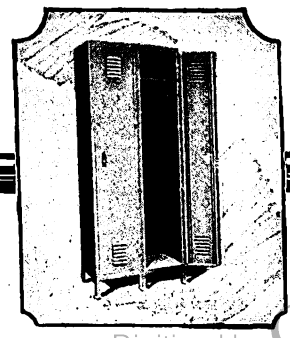


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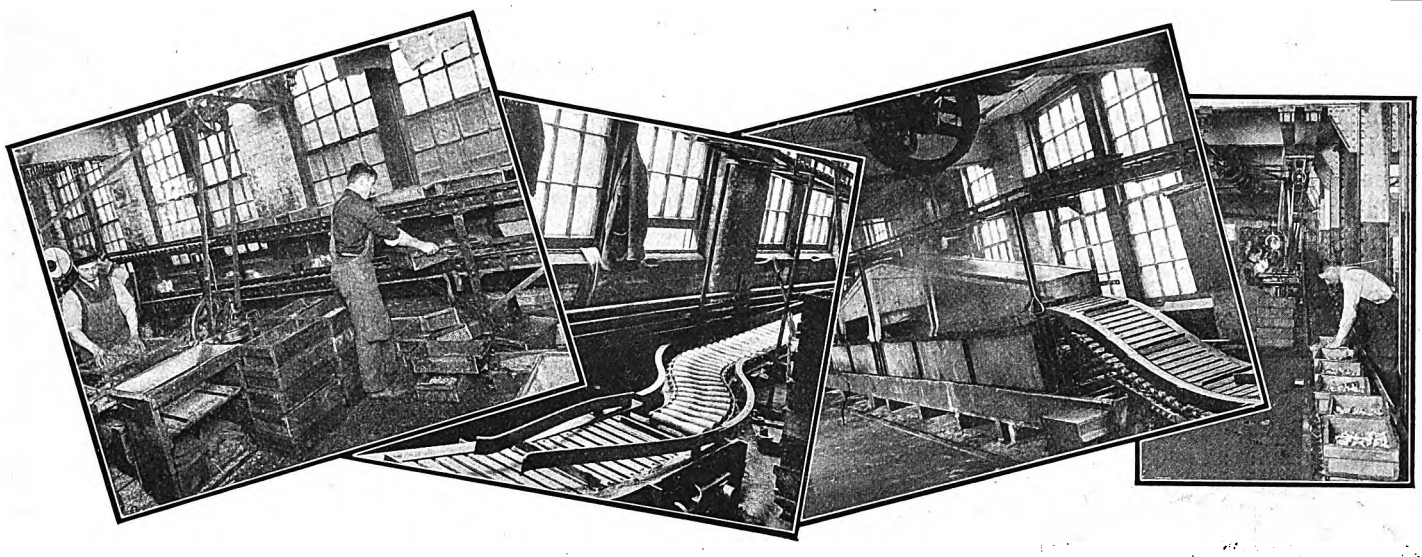
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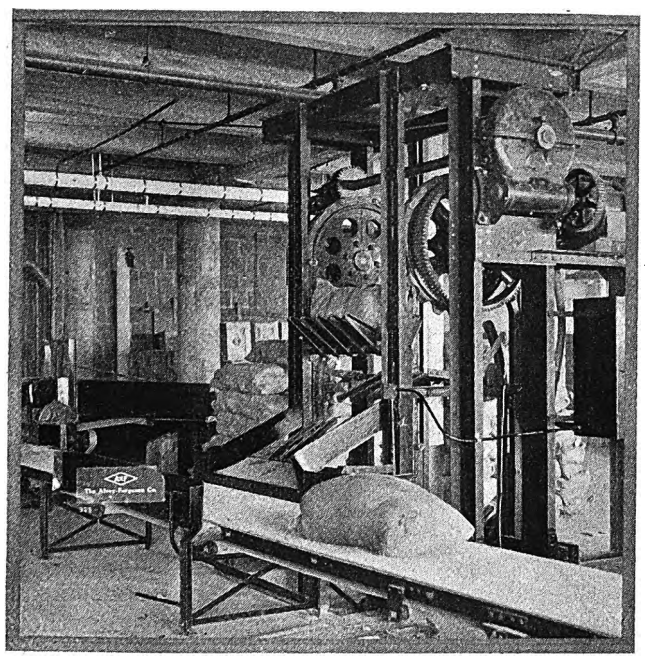


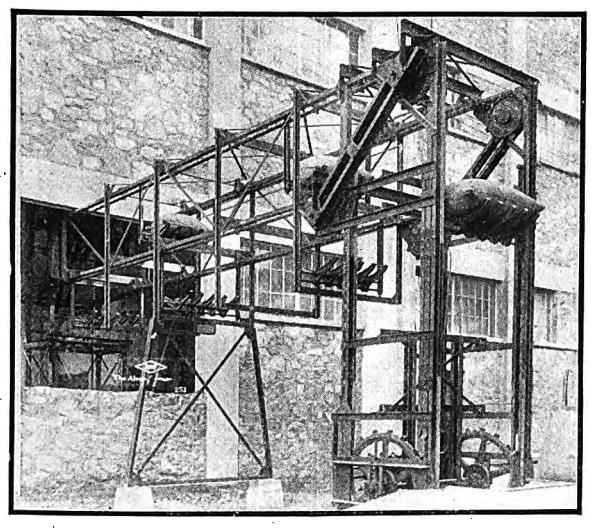
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A-F CONVEYORS are a victory over the problems of industrial transportation. And their economy is not limited to the handling of one or a few specific types of packages or products. If you could visit some of the hundreds of plants A-F equipped, you would find products of widely varying weights, shapes and sizes being handled with absolute satisfaction.

Our Engineering Service Bureau stands ready to study your particular requirements and assemble the various conveying units best suited to the exact work at hand. You do not have to guess when purchasing A. F. Conveyors. You know their true value in *your* plant before you buy. The assistance of Alvey Ferguson Engineers is yours without cost.

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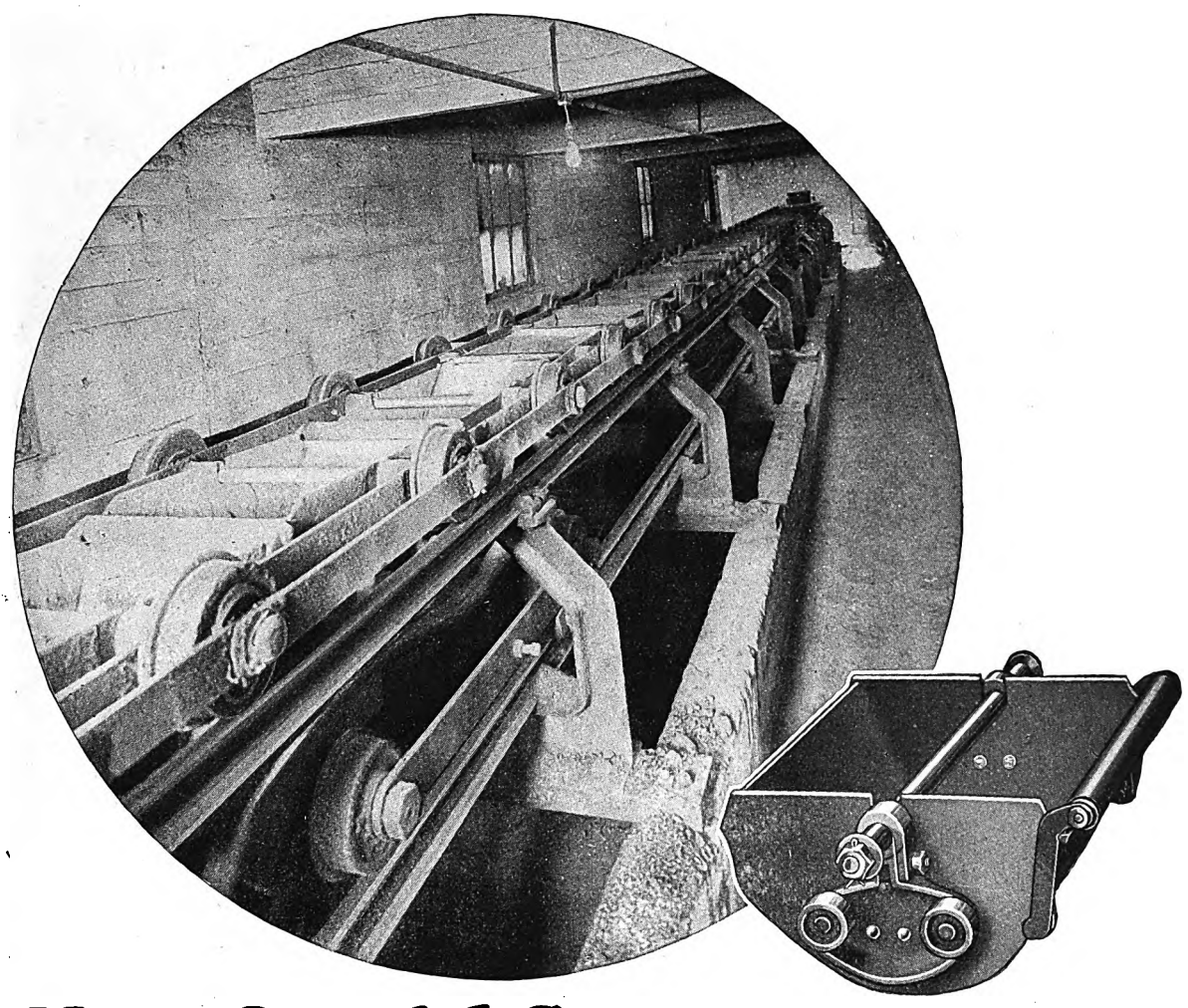
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(*Continued from page* 60)

Instances without number could be cited where the laboring men have stood in their own light in objecting to the use of machinery and in nearly every case the responsibility for the failure of the laboring man to look kindly upon the use of machinery rests with his employer. If the employer attempts to thrust machinery down the laboring man's throat, he can expect difficulties sooner or later.

In every case where labor saving machinery is installed the employer should see to it that the men themselves are in favor of the use of the machinery. They should be given to understand that the world is continuing to progress and that the time will undoubtedly come when all of the disagreeable and burdensome tasks are removed from the shoulders of the laboring man.

The last fifty years has seen more new machines developed and more disagreeable tasks removed from the shoulders of men than has been made in all our previous history.



If You Could See

THE Perkins Pivoted Bucket Carrier At Work—discharging a continuous stream of coal on the upper run and ashes on the lower run of conveyor—at a tremendous saving of man power—

YOU would clearly understand the great preference for this ideal, economical conveyor. Your first impression will be quickly confirmed when you see how perfectly this bucket carrier works in the boiler room.

The Perkins Pivoted Bucket Carrier handles both coal and ashes with low operating and maintenance charges. It does the work mechanically releasing labor help for more profitable work.

Sturdily built and mechanically correct in design it insures years of reliable and dependable service. This is demonstrated by the number of Webster installations successfully operating in power plants today.

Our trained staff of engineers is at your service and will furnish particulars of this improved bucket carrier upon word from you.

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If we would look back and see the progress which has been made in the past thousand years the results would be surprising.

In discussing the evolution and progress of a sailor's job with an old sailor, the writer was not surprised to find that the old gentleman felt that the world was going backwards. He stated that the days when he was on the sea, thirty years ago, were the days of wooden ships and iron men, and that today is the day of iron ships and wooden men, but if this same sailor were to look back a thousand years he would find that the sailors in those days worked in the galley on the short end of a long oar and that eight-hour days were unknown to them.

Only five years ago the washerwoman looked with jealous eyes upon the increasing popularity of the electric washing machine and today it is practically impossible to obtain a washerwoman in any of the larger cities unless an electric washing machine is provided.

The laboring man of today must be made to realize that for the past thousand years machinery has been slowly but surely removing or reducing the load on their shoulders.

The men who are truck drivers today carried their loads on their backs a thousand years ago and they were not light loads either.

The men who are taxicab drivers today carried their passengers in baskets suspended on long poles a thousand years ago. Speeding was an effort in those days.

A thousand years ago the galley slaves undoubtedly objected to the application of sails on their boats as they felt that the use of sails would take away their jobs. They did not realize that the application of sails was the best thing that could happen to them because they were automatically advanced to a higher position in life not through any effort of their own, but because what was possibly the meanest job on earth was eliminated by a form of machinery and they had to get out and find a higher job whether they wanted to or not.

So it is today, machinery is continuing to eliminate the "meanest jobs" on earth and the men who are now occupying these jobs are automatically advanced to a higher position in life whether they want this advancement or not.

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The Question of Crating

(*Continued from page* 21)

been using a low-grade hardwood for the crate because it was cheap and had not realized that this was piling up 2,000,000 pounds of unnecessary weight annually upon which to pay freight.

Another manufacturer is saving $30,000 a year by the use of a re-designed crate for one export item, the saving being represented by a saving in lumber, a saving in labor and a tremendous saving in water transportation, where unnecessary bulk in a package brings a high penalty. During the war the re-designing of a cartridge case saved the Ordnance Department of the Government $50,000 on the first contract, besides saving $100,000 in cargo space.

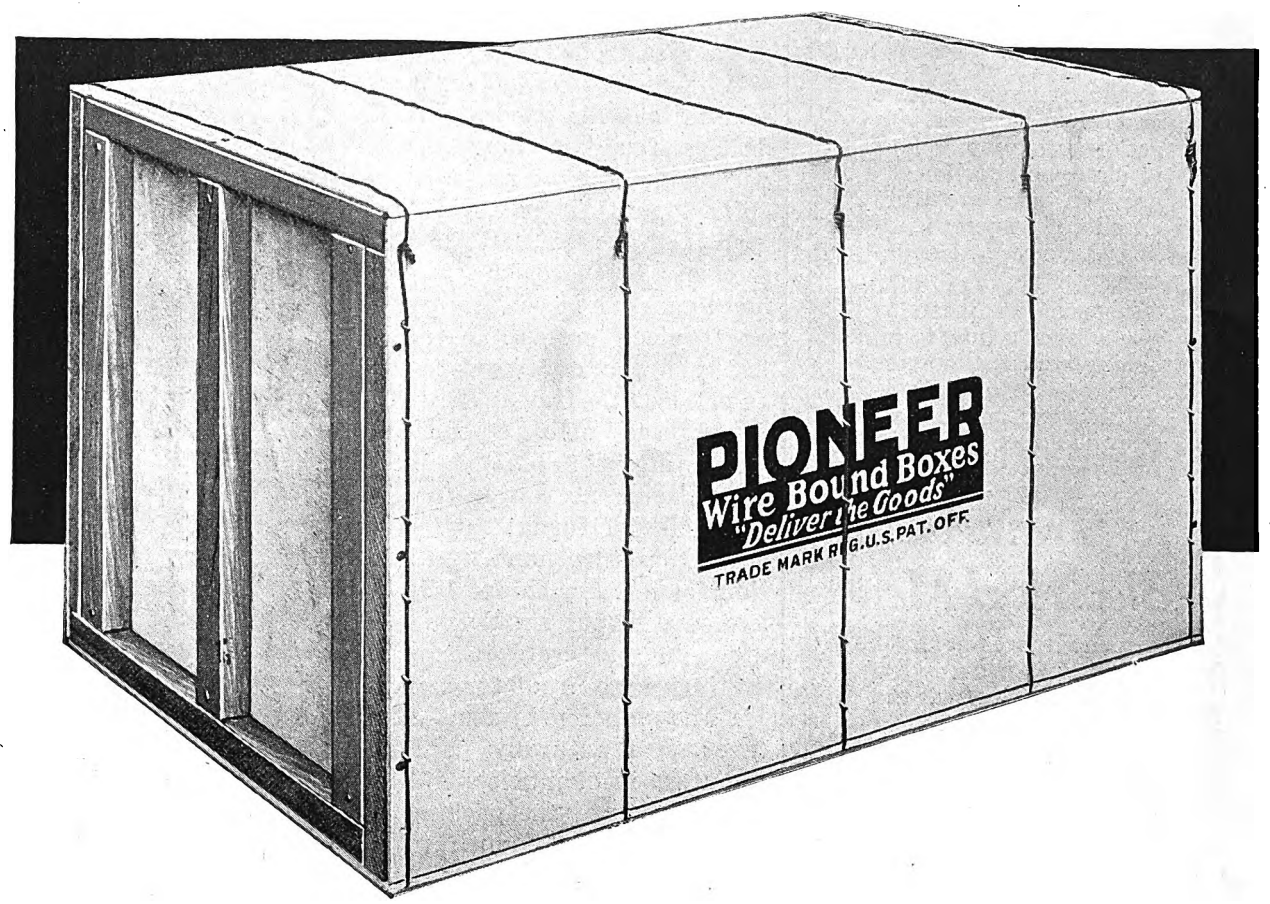
In one plant, improved design and a change in the dimensions of some of the timbers saved 52 per cent. of the lumber in a crate for an automotive axle and made the package 112 pounds lighter. Yet, due to the improvements made, the new crate was stronger. A new crate for a washing machine saved 11.9 feet of lumber and 39 pounds in shipping weight, and a plan of building it in sections enabled workmen to build it in half the time required for the old crate.

Instances might be piled up at length, cases where re-designing of crates is saving manufacturers all the way from 10 to 50 per cent. of the lumber formerly used, making consequent large reductions in freight bills and cutting down on the labor required.

Using less lumber, the engineers in many cases can give the goods much better protection. Scientific crating, according to the engineers, will stop much of the damage to goods now incurred in shipment. Railroads pay out $100,000,000 a year in claims for lost and damaged freight, a large part of it due to improper packing. Tests made by the United States Forest Products Laboratory tend to bear out the conclusion that most of the damage to goods received in shipment can be eliminated with proper care by shippers, and packing engineers have shown that in very many cases it actually can be done by using considerably less lumber.

For illustration, take the matter of diagonal bracing, the lack of which is responsible for the failure of many crates. A crate that is properly braced diagonally will stand twice the force that would ruin an unbraced crate when dropped on a corner. Likewise, the three-way corner adds tremendously to the strength of a crate, the corner being the weakest part of the ordinary crate. And so with other devices which can be employed.

Aside from saving waste, good packing has a tremendous value from a merchandising standpoint. The dealer who is waiting for an order of goods for an impatient customer and finds the goods so badly marred on arrival that they cannot be sold isn't going to have a very good impression of that particular manufacturer. Little things often, like the use of nails that are too large or some such slight error in crating, can have far reaching effect in destroy-



What the Pioneer Wirebound Box means to you

THE cost of shipping is a matter of increasing interest to manufacturers. The heavier-than-necessary box, the lighter-than-needed box, the broken box, the easily-pilfered box, the one-trip box, the poorly-designed box are items of waste that place a heavy tax on industry.

To you Pioneer Wirebound Boxes and Crates mean the elimination of this burdensome tax—if they can be adapted to your product. Pioneers are made in many sizes and shapes. They are used by manufacturers in many different industries. Likely you, too, can use them.

On your request we will be glad to send a General Box Engineer to study your requirements and design a Pioneer to suit your needs. This will place you under no obligation of any sort.

Pioneers give your goods maximum protection at a surprisingly low cost. Stronger and lighter than nailed wood boxes, they cut lumber waste and save transportation charges.

Made of tough rotary-cut lumber and bound with strong steel wires, they are practically immune to the destructive shocks and strains of shipping. Fastened and sealed against theft in one operation.

Pioneers are delivered to you in flat folding form and three-fourths assembled. Save storage space or assembling costs.

Your customers appreciate receiving shipments in Pioneers, for they can open Pioneers just by clipping the wires. The top throws back, making it easy to unpack. By splicing the wires—a simple thing—the box is ready for reshipment.

Write for General Box Service—a booklet of information on better boxing and crating methods.

GENERAL BOX COMPANY

508 North Dearborn Street, Chicago, Ill.

Sixteen Factories give you close at hand Service:

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IN this day of constantly increasing use of Electricity for power and other purposes, you at times undoubtedly find it almost impossible to get men who are truly capable of properly handling your electrical equipment.

What would it mean to you at such a time to be able to secure, almost at a minute's notice and without expense to you, your choice of a number of experienced and

Trained Electrical Men

—men who are not afraid of work—men who know electricity from the ground up—men on whom you can absolutely bank on to do a job quickly and right?

Our business is to train men for Electrical work. We do not claim to make Electrical Engineers, but we do claim that our graduates are expert Electricians, men capable of handling any kind of installation, operation, maintenance or repair work.

Our Service Is Absolutely Free!

to employer and employee alike—we make no charge of any kind to either employer or to the man employed. Let us tell you more about this service. Write

L. L. COOKE
Chief Engineer
Chicago Engineering Works
2150 Lawrence Ave. : Chicago

"Cooke Trained Men KNOW Electricity"

ing good will. The man whose goods come in a nice package holds his customers, and payment of his accounts is not delayed while adjustments are being made.

But good packing is more than designing a container. The manufacturer, if he is going to do the job in a really scientific way, must take into consideration the nature of his product, trade practices, habits of his customers and a score of other things. Failure to follow the question to its bottom may prove disastrous.

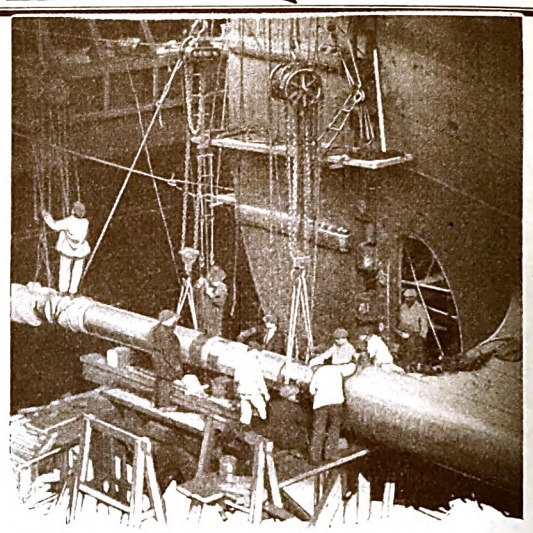
A manufacturer of furnaces, sending out his goods to retail dealers, found it convenient to pack a number of furnaces together, putting parts of one kind in the same crate. To assemble a furnace, the retailer had to get one piece from twelve or fourteen crates. After he had got one or two furnaces assembled, the remainder were a confused mixture of parts and crates in his basement. This dealer no longer handles this make of furnace.

On the other hand, the solution for another shipper's problem was to put six truck radiators in one crate instead of crating each radiator singly. He was shipping to a manufacturer who naturally used the radiators in quantities.

The work of the packing engineers has done much to increase interest in correct crating, and in many cases shipping practices of big industries have been changed radically as a result. It is unusual to see a big lumber firm hiring engineers and sending them out without any charge to help shippers improve their crates and get along with less lumber, but it will be admitted readily that it is good merchandising. At the same time, it represents a very practical step in conservation. While everybody is talking about conservation, here is a kind of conservation, of which shippers can take advantage right now, and to their immediate profit, too.

By applying proper methods of construction, reports the United States Forest Products Laboratory, it is estimated that from 25 to 50 per cent. of the lumber required for boxes and crates can be saved. That means two to three billion feet annually, and is at the same time a good illustration of one way to reduce freight bills.

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HIGH SPEED



—make light work of heavy jobs!

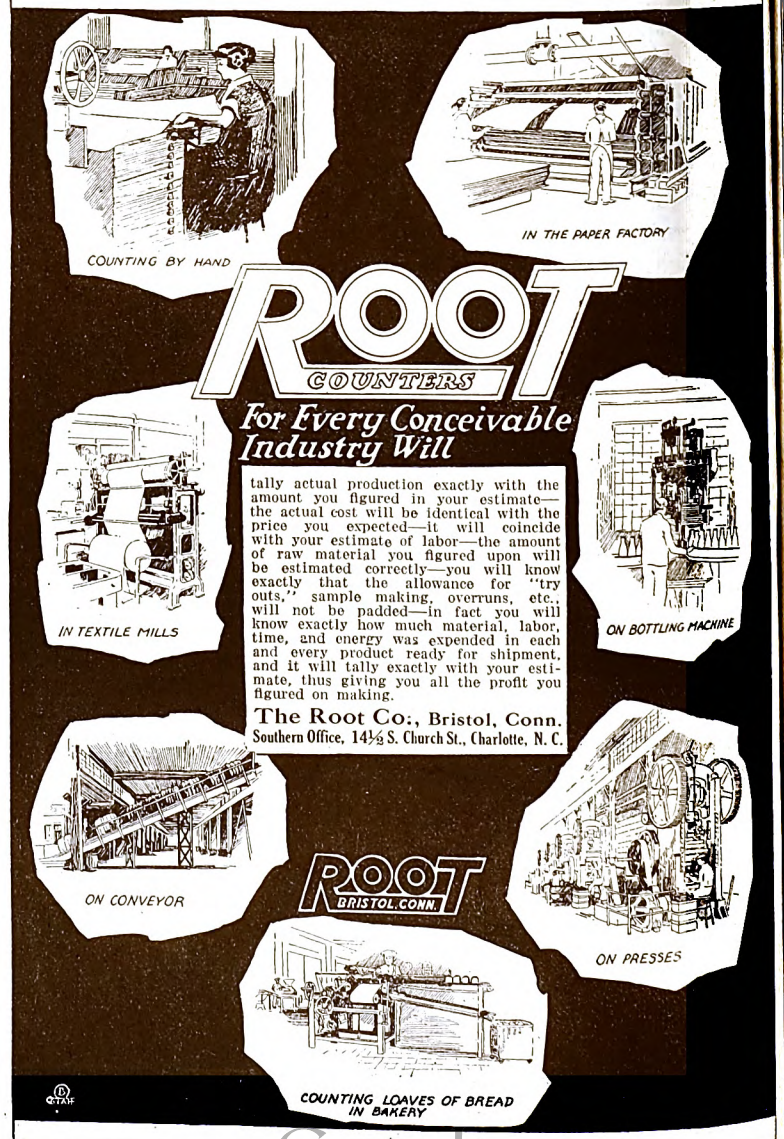
WHEN the huges propeller shaft of the U. S. S. America had to come out for repairs, Cyclone Hoists bore the brunt of the lifting.

The mechanics, mere pygmies in relative comparison to the giant task before them, aided by Cyclone Hand Chain Hoists handled the ponderous shaft as easily and deftly as though it weighed pounds instead of tons. Whenever and wherever the men in your plant are up against a lifting job team them up with a Cyclone Hoist.

Distributors Everywhere.

Catalog covering 1 to 40 Ton Hoists Cranes, Trolleys, and Overhead Track Systems sent on request.

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Hoists Cranes Trolleys
Overhead Track Systems
Branches: New York, Chicago, Pittsburgh

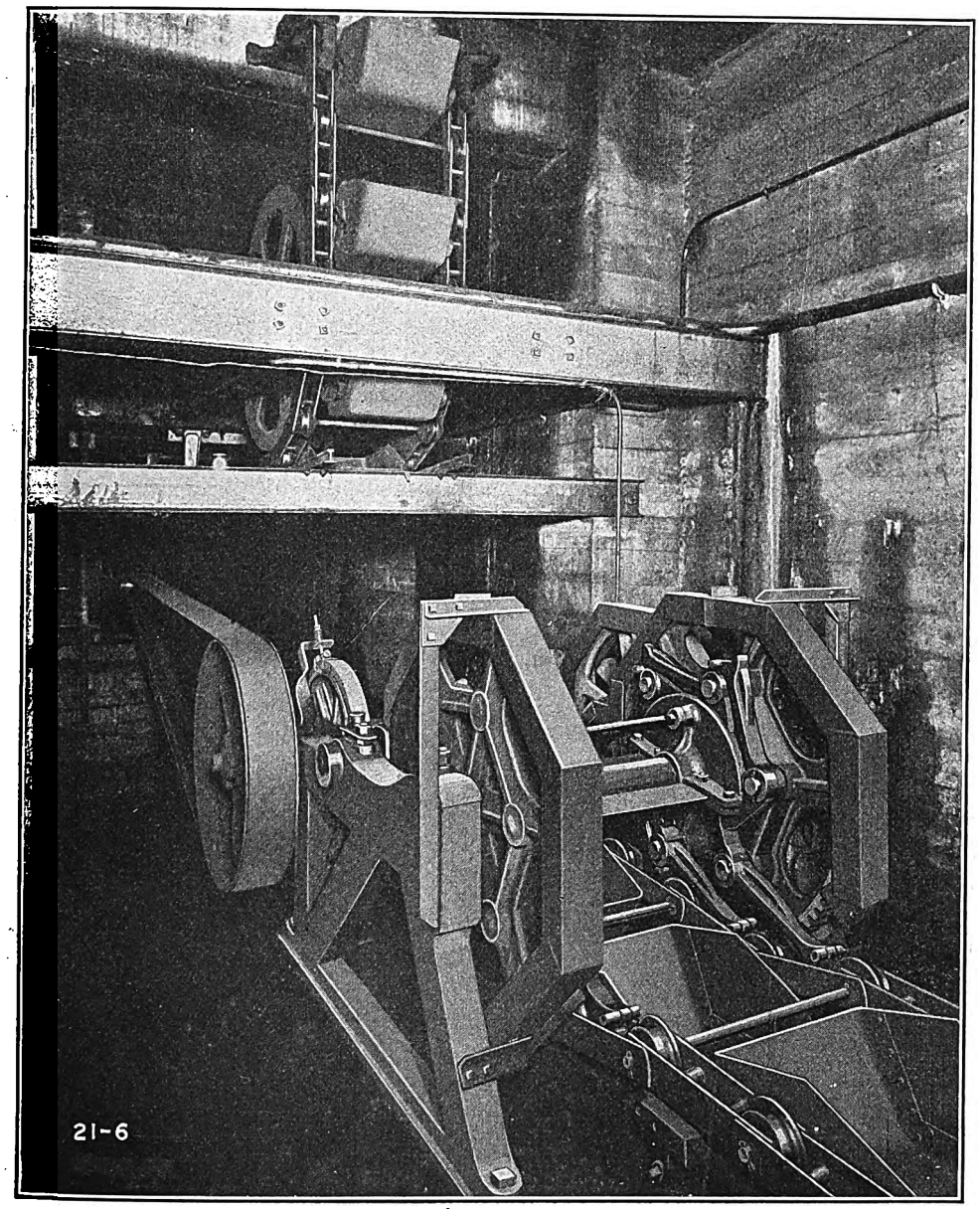


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STUNTED VISION

"Many industrial executives keep their noses so close to the grindstone of production that they fail to see that the stone needs dressing or that the belt which drives it is slipping."

From an editorial in Industrial Management, November, 1923



The Hunt conveyor is driven by a Hunt Standard Pawl Driver, consisting of a number of pawls driven by a gear wheel. These pawls are of cast steel and engage with the studs between the links on each side of the conveyor, giving a smooth, even and continuous motion to the chain. This method of driving on studs in chain relieves wheel bearings from the driving strain to which they are subjected with other types of drivers. As the end of the pawl rolls on the stud, no wear occurs at this point, and any variation in the pitch of the driving studs, due to wear in the links, such as is bound to occur in a conveyor with vertical lifts and after long operation, does not affect the evenness of the movement. This is a distinct improvement over sprocket drives where constant pitch is essential to satisfactory operation. Behind the cross beam is shown a Hunt Revolving curve by which change of direction of chain is accomplished.

We quote further from this pithy editorial, "Keeping the Plant Fit for Profits!":—

"Concentration on production is admirable and effective, provided we are organized to concentrate likewise on the things that keep production going."

While this editorial was written primarily to induce better care of plant and equipment, we use it in a broader sense to cover not only the object for which it was intended, but also as applying to the initial installation of equipment as well.

Too much care cannot be exercised in the selection of all apparatus intended for the equipment of the plant; for "breakdown insurance protection" is dependent in as large a measure on a wise *selection* of apparatus, as it is in the proper *maintenance* of the apparatus after it is installed.

In the matter of coal and ashes handling, or the handling and rehandling of other bulk materials, the equipment for performing these functions should represent the highest type of their class; in which ruggedness, freedom from serious breakdowns, low upkeep and long and satisfactory service under all conditions are the dominating features.

Over half a century ago C. W. Hunt conceived and developed a number of devices destined to lessen the labor and cost of handling coal, ashes and other materials in bulk; to move them with rapidity and safety and effect greater economies in boiler-room and plant. He built well; laying particular stress on the workmanship and material entering into their construction.

Today, there exists Hunt Cost-Cutting Equipment that has withstood the severest kind of service for from eighteen to thirty years, with only minor repairs. Which proves conclusively the ruggedness and reliability of Hunt Apparatus.

Let Hunt Engineers give you the benefit of their half century experience and accumulated data on coal, ashes and bulk materials handling, to assist in "Keeping the Plant Fit for Profits."

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Fighting Friction in the Modern Power Plant

(*Continued from page 27*)

parts should be properly lubricated with a carefully prepared oil suitable for the service intended. As a result, the petroleum expert, of necessity, became a mechanical engineer, or vice versa, or else the two put their heads together to study machine design and lubrication requirements collectively, and the matter of developing suitable lubricants to meet these requirements.

The culmination of all this has not only been an extensive advance in the science of oil refining and compounding, but as well, the development of automatic lubricating equipment of many intricate and ingenious types. It was soon found out that the oil can was inadequate to meet the requirements of modern high speeds, bearing pressures and loads. Therefore, the oiler in actuality by necessity has given way to the oile in name. In fact, the sight of dirty, greasy individual clambering over a piece of machine with an oil can in one hand and a piece of waste in the other, is a rarity today. The oil can is all that remains, and it, more often than not, is but an emergency accessory in case some lead from the automatic lubricating system should clog or otherwise become inoperative. Then only would the engineer deign to use it, but rest assurred, it would probably be used in a very effective manner. Just because conditions have ordained that he shall no longer "swim" in oil is no reason for his having forgotten how to use the old reliable squirt can. In fact, it is these very conditions that have graduated so many power plant operators from "oilers" to engineers. But clean overalls and the ability to make out a log sheet without turning it into an "oil painting" have not harmed any of them. Today our power plant operator is a student; he can, in all probability, discourse very effectively on the science of combustion, etc., and can hold his own with any lubricating engineer when the latter reels off information regarding viscosity, demulsability, and compound, etc. All in all, an admirable situation has developed,—all due to the progress that has been made by lubrication and lubricating equipment over the past few years.

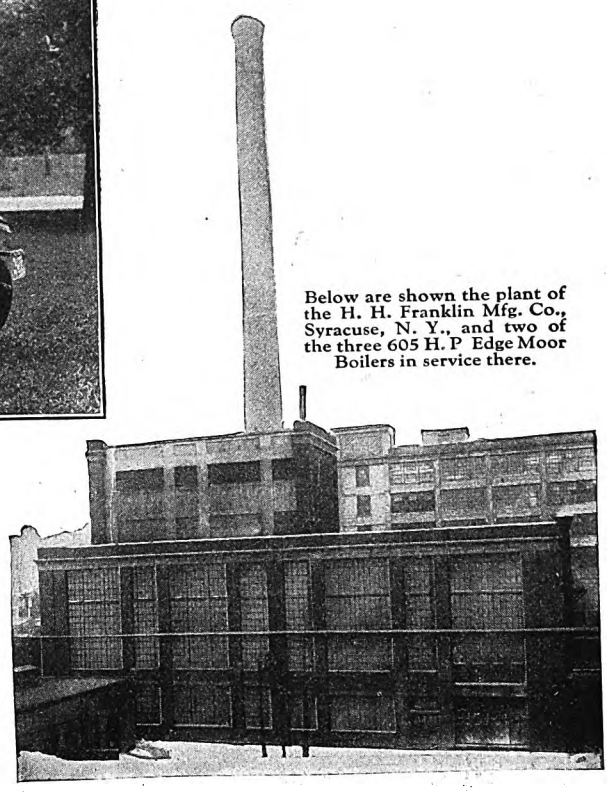
Lubricating equipment has been extensively dealt with in INDUSTRY ILLUSTRATED for March, 1923. In this article we have, therefore, to deal with lubricants. Power plant lubricants can be generally classified under several headings, according to the particular service for which they are intended, *i. e.*,

Steam cylinder lubrication
Turbine lubrication
Engine and Machine Service
Economizers and Stokers
Electrical Equipment
Grease lubrication

Steam cylinder lubrication involves probably more variables than any other class of lubrication. The nature of the steam, the type of engine, the design of lubricating equipment, the arrangement of steam piping, and load conditions all must be given due consideration. Steam cylinder lubrication differs from external lubrication in that the lubricant is not directly



The FRANKLIN



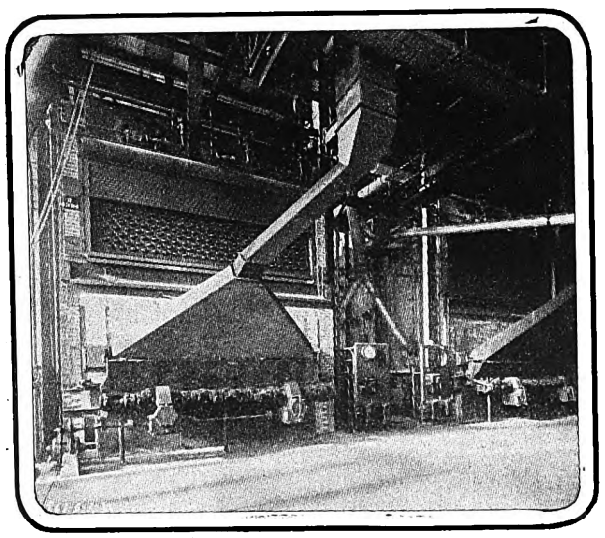
Below are shown the plant of the H. H. Franklin Mfg. Co., Syracuse, N. Y., and two of the three 605 H. P Edge Moor Boilers in service there.

THE qualities that have won unusual success for the Franklin car—economy of operation and maintenance—are no less important attributes of a steam boiler.

These same essential qualities have made possible the outstanding records of the Edge Moor Water Tube Boiler in a score of leading industries.

Franklin standards of manufacturing demand the most efficient equipment for the big plant at Syracuse. Power used there is generated by three Edge Moor Boilers of 605 H.P. each.

Reasons for the exceptional dependability and economy of the Edge Moor Water Tube Boiler are fully described in Catalogue 63. A copy will be promptly forwarded at your request.



EDGE MOOR IRON COMPANY
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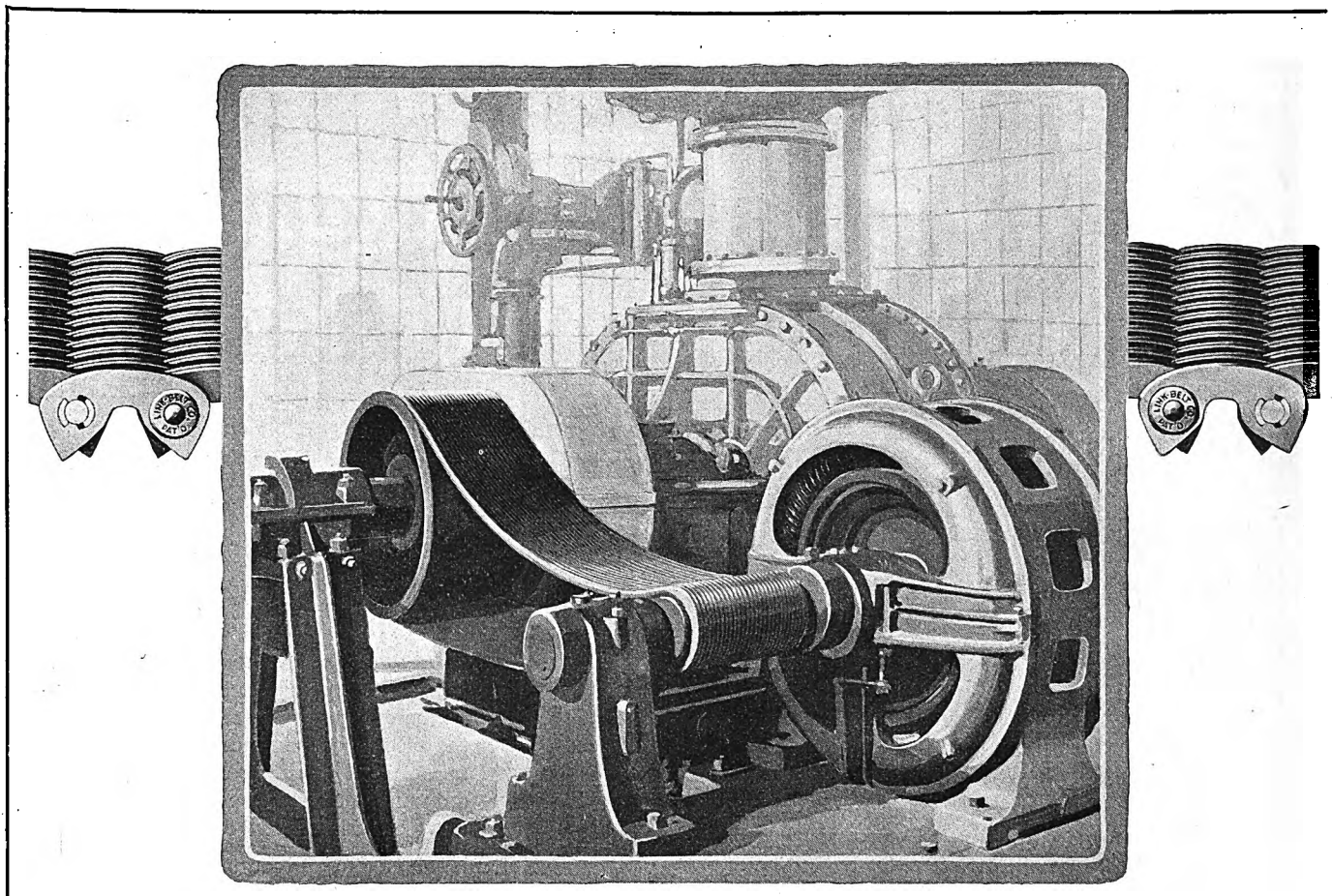
applied to the wearing surfaces, but rather is delivered into the steam line at some point adjacent to, and a few feet above, the throttle valve. Thus the steam serves as the transmitting medium for the oil. However, in order to insure the formation of an adequate film of lubricant and the proper lubrication of the wearing surfaces, the oil must be atomized or divided into minute globules, else it will not reach all points of the valve seat and cylinder walls. In general, steam serves as the atomizing as well as the carrying agent, the oil being delivered to it at approximately the point of highest velocity via a perforated or slotted, spoon-shaped extension of pipe, which is screwed into the pipe at right angles.

It has been definitely proven that the physical condition of the steam will affect the atomization of the oil. For example, oils of low viscosity, containing a certain amount of compound, are more readily atomized than higher viscosity-pure mineral oils. Also, wet steam will increase the atomization of the oil. It has also been proven that high temperatures and velocities in the steam lead to more complete atomization of the oil, although high velocity will require the use of a lower viscosity oil, while high temperature, due to its tendency to promote evaporation on the cylinder walls will require the use of an oil of lower volatility, or else the rate of lubrication will have to be increased to a certain extent. Due to the fact that steam temperatures increase with pressures, the extent of superheat (if any), as well as these other factors, must be considered.

In general it may be assumed that the viscosity of a cylinder should be such that the latter will be able to stand up under piston and valve pressures at the temperature of operation; and the extent of compound must be governed by the extent of moisture in the steam. As a rule, it is possible to obtain cylinder oils capable of meeting such conditions as the character of the steam may require.

The type and construction of the engine will require quite as much consideration in the selection of a suitable steam cylinder oil as the nature of the steam. Such items as whether the cylinders are located horizontally or vertically, the valve design, the speed of operation, and the tightness of the piston rings will enter into the problem. Corliss engine valves are generally regarded as the more difficult to lubricate, due to the fact that the steam pressure holds them relatively tightly upon the seats. Vertical engines, and those equipped with tail-rods will involve relatively little weight of the moving parts being carried by the cylinder walls and valve seat, hence there will not be the same tendency towards scraping or washing off of the oil film. The rate of delivery of the lubricant can, therefore, be decreased, or, as is often customary in marine service, where using saturated steam, the oil may be done away with and the moisture in the steam relied upon to develop a "water polish" on the cylinder walls, and serve as a lubricant. In stationary practice, as a rule, the lubrication of a vertical engine will involve the same factors as that of a horizontal engine, similar lubricating equipment can be employed, and, therefore, the selection of the lubricant carried out in much the same manner.

In certain power plants boiler





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compound will often be used. This fact must normally be considered when making the selection of a cylinder oil, due to the possibilities of foaming and priming occurring. As a result of this, excess amounts of water which might enter the engines would contain considerable percentages of boiler scale, silica and lime, etc. Substances of this nature have a tendency to saponify cylinder oils which have been compounded with animal fats, with the result that the oil film may be washed off the cylinder walls, etc., in a short space of time.

The lubrication of steam turbines is perhaps the most important phase of power plant lubrication with which the engineer will normally have to deal. High speeds, the probability of considerable heat reaching the bearings, the possibility of steam leaks and water in the oiling system, and frequently inefficient oil purification equipment, all impose severe duty upon the lubricant. Therefore, the utmost care must be observed in choosing it. There are two essential characteristics which must be considered when selecting a steam turbine lubricant, *i. e.*, viscosity and demulsability; though, of course, as well the oil should be a pure, filtered, highly refined product, non-acid in reaction, with a low affinity for water and free from animal or vegetable compounds. Water is the chief element of objection in a turbine oil, and has the most effect upon its serviceability. As a result, the greatest care should be taken to prevent it from entering the oiling system, storage tank, or purifiers.

There are three general means for lubricating steam turbines, *i. e.* (a)—Ring and chain oilers. (b)—Gravity circulating systems, and (c)—Force feed circulating systems.

The first are generally found in smaller machines of about 300 horsepower or less. In such systems the bottom bearings are built with oil reservoirs, and rings or chains are suspended from the shaft. By filling these reservoirs with oil to a certain level, the rings or chains will carry a continuous feed of oil to the shaft when it rotates. This oil is distributed lengthwise along the shaft via suitable oil grooves cut in the top bearing or cap. As long as ring oilers are maintained in proper adjustment and free from vibration, operation will be satisfactory. It is important to keep ring surfaces smooth and free from sharp or jagged edges, otherwise their action may be impaired.

In a ring or chain oiling system the size of the oil reservoir is of importance, due to the fact that frictional heat must be removed. As a rule, this heat will be partly absorbed by the oil in the reservoir and partly radiated to the air; though in certain installations cooling coils may be installed. At all events, the oil reservoir should be large enough to allow sufficient time for the oil to remain at rest in order to insure against excessive heating, and to enable the precipitation of sludge, etc.

Gravity and force feed circulation systems are customarily installed on turbines of larger size. The volume of oil in service is considerably greater than in ring oilers. Due to the fact that such systems are usually installed in conjunction with oil purifiers of some sort, the possibility of overheating or contamination is materially reduced. In general, gravity cir-

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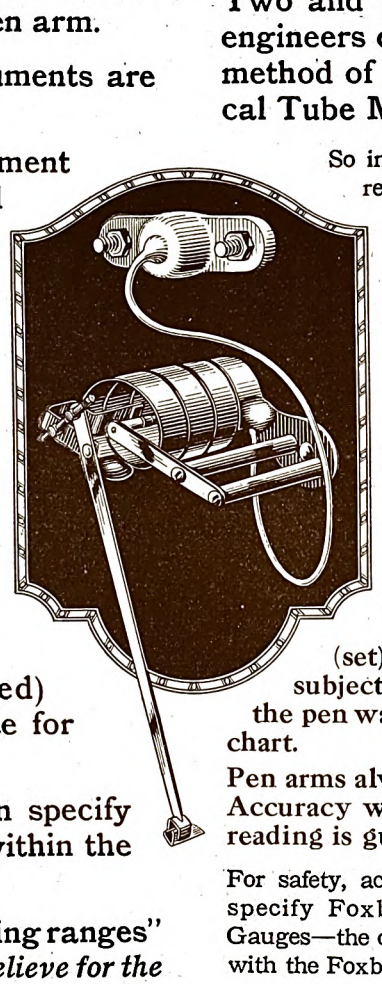
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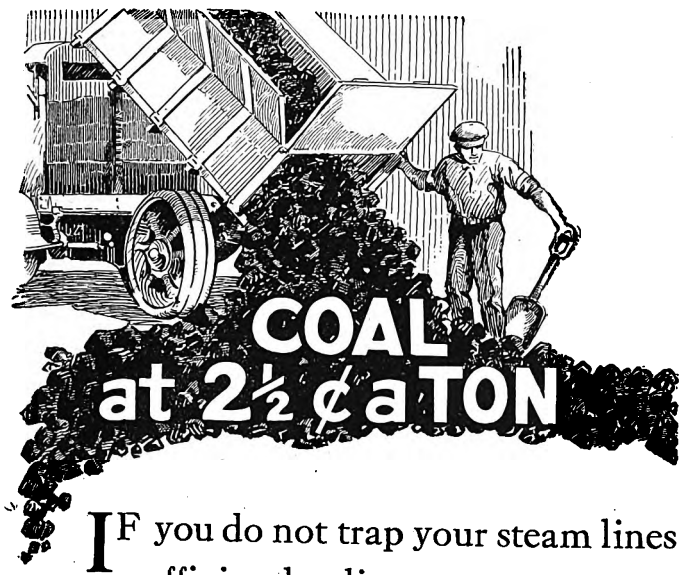
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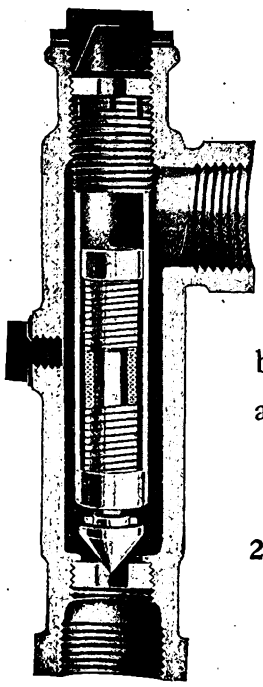


IF you do not trap your steam lines sufficiently, live steam can go straight to the sewer—and with it goes the cost of the coal burned to produce the steam. Just one untrapped ¾" steam pipe would waste more than a ton of coal every 52 hours.

You can positively prevent that waste at a cost of $9.45 list, for a

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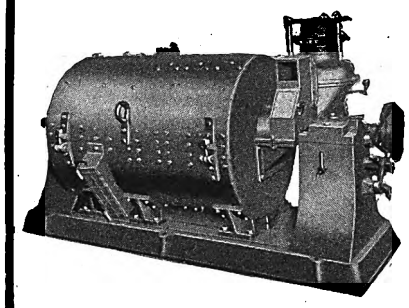
culating systems are larger and more bulky than force feed, due to the greater storage capacity that is required. This is of advantage in that a large amount of oil can be fed instantly to any bearing in event of indication of overheating, thus maintaining the proper temperature by sheer volume of oil.

Engine and machine lubrication is a term often applied to the external lubrication of reciprocating engines, pumps, compressors, and miscellaneous auxiliary machinery in the power plant. There are numerous parts on such equipment such as guides, pins, crossheads and rocker arm bearings, where the lubricant must be applied externally, either by means of oil cans, oil cups, force feed lubricators, splash oiling systems, or grease cups,—hence the term external lubrication. Oils for this purpose are known as engine and machine oils. They should be selected both according to the operating conditions they are intended to meet, and their physical adaptability. In choosing an oil of the proper viscosity for such service, consideration should be given to the size of the bearings, the speed of the machine, the probable quantity of oil necessary to insure efficient lubrication, and the operating temperatures prevalent. In any case the idea should be to obtain an operating viscosity in the oil such that a suitable film of lubricant will be maintained at all times, and to insure against the oil flowing through the bearing too rapidly.

The essential points to observe in selecting an efficient and economical engine and machine lubricant are:

1. The viscosity must be sufficient to prevent metal to metal contact.
2. Tendency towards breaking down, decomposition, gumming or emulsification should be as low as possible.
3. Internal friction in the oil film must be low. This is often regarded as a function of the viscosity.
4. The lubricant should flow readily when required, however low the operating temperature. In a semi-solid lubricant this applies to the oil content.
5. There should be no tendency towards liberation of acids or alkalis which would tend to corrode the bearings.

Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

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6. No abrasive fillers or thickeners should be used which would tend to wear the bearings abnormally.
7. The oil should separate readily from water, sludge or other foreign matter, should it be destined for usage in a circulating or splash feed system.
8. The vaporization tendency should be as low as possible.
9. The flash point should be so high as to insure safety in operating even under abnormal temperature conditions.

The nature of the oiling system will influence the selection of an engine or machine oil to the extent that there should be a certain relation between the viscosity and the amount of oil fed to the bearing. For example, hand lubricated or cup-oiled bearings, which are usually incapable of being flushed out with oil, must naturally retain their oil over a longer period of time than is necessary in splash or circulating systems, hence a somewhat heavier oil is usually selected for such service.

Where it is possible to maintain a steady and comparatively uniform stream of oil in contact with the bearings as in splash and circulating systems, the frictional heat generated will be carried off to a considerable extent by the flood of oil. In such lubricating systems it is decidedly essential that the oil be capable of separating readily and rapidly from water, sludge and foreign matter. In splash systems the lubricants receive comparatively severe service, being passed through and through the systems with relatively little time for cooling or settling, and usually without any purification whatever.

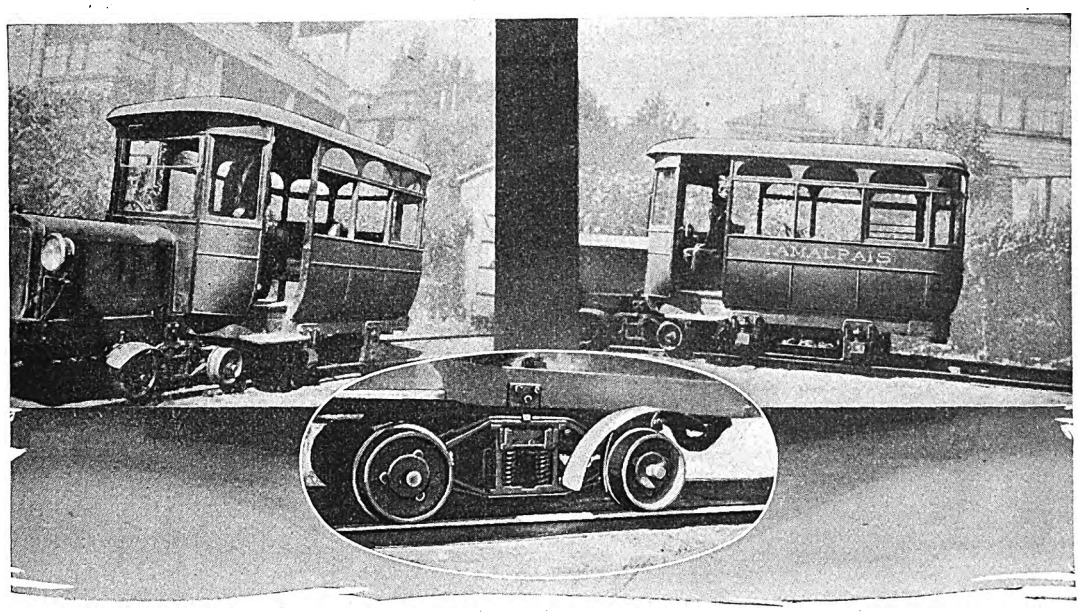
Economizer and stoker mechanisms involve no difficulties as a rule in their lubrication, and the same grades of lubricants as used elsewhere in the power plant will be suitable. In the case of economizers we will normally have to deal with the scraper driving mechanisms and with the forced draft fan and its motive power. Scraper driving mechanisms will include the motors and such other features as the reversing devices, gears, chains and miscellaneous bearings. Motor lubrication is discussed hereafter. On the other equipment it will be merely necessary to insure the frequent and proper application of a good, adhesive gear and chain lubricant, selected according to the type of driving chain installed, (if any). Such a lubricant should never be so generously applied as to drip or be thrown off by centrifugal force, in event of abnormal rises in the operating temperatures. Shaft bearings are usually of the split or solid babbitted type equipped either for hand oiling, or with oil or grease cups.

Forced draft is often necessary in many power plants, in which event mechanical draft fans are installed. Usually these are driven by small single cylinder, horizontal or vertical steam engines, or electric motors. Engine lubrication is identical with that of the main units, the features of which have been mentioned heretofore.

Stoker lubrication is akin to economizer lubrication and involves much the same type of equipment and lubricants. There is also the same problem of probable high surrounding temperatures, hence the lubricants must

(Continued on page 72)

SKF



Ball Bearings in Operation 7 Years
Over World's Crookedest Road, Grade 7%

SUBJECTED to severe side thrusts and making a seven per cent grade on "The Crookedest Railroad in the World," the Hess-Bright deep-groove ball bearings on the front truck of this car running up Mount Tamalpais, California, have been in continuous service since 1916. The original ball bearings are still in service and have never been removed from the truck for any cause.

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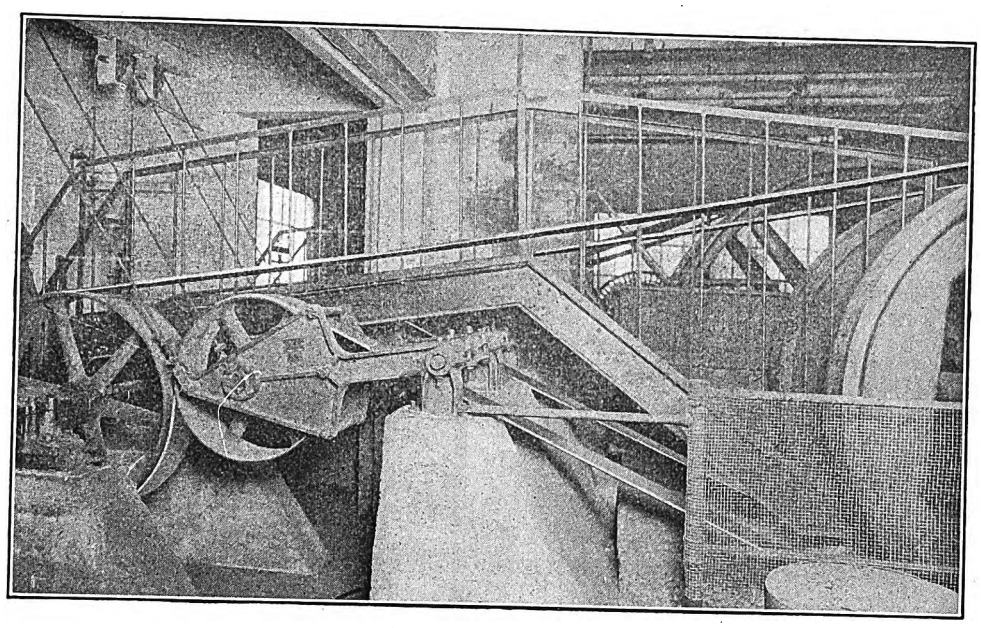


Cross Section of Single-Row Bearing

Cross Section of Double-Row Bearing

BALL BEARINGS
The Highest Expression of the Bearing Principle

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Lineshaft turned by 200A Motor also with Lenix.

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Is the *original* short center belt drive.

In the eighteen years that have elapsed since the first Lenix was placed in operation, thousands have been sold. The drives on which they are installed range from 1 to 1400 HP with belts from 2" to 60" wide. Some of the drives have the tight side of the belt on top, some on the bottom; some are horizontal drives, some vertical and others quarter-turn.

The Lenix is not an "idler." It is a "belt wrapper," scientifically applied to belt drives for the purpose of eliminating belt slippage and increasing the capacity of the drive.

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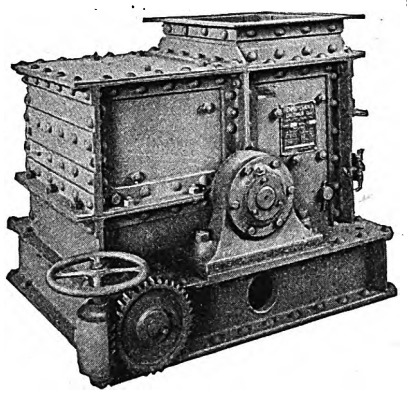
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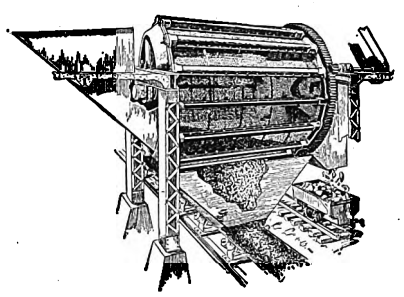


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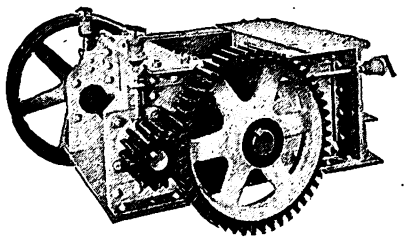
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For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

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(*Continued from page 70*)

be selected with this fact in mind. In general we will have to deal with the lubrication of gears, chains, shafting, and the driving engine or motor. Mechanical stokers can be broadly classified as being driven directly, or by worm or spur gearing. Stokers operate at relatively slow speeds, and for this reason reduction gearing is usually provided to step down from the higher speed motor, turbine, or steam engine. The question of the suitable gear compound must be decided by the type of drive, *i. e.*, with a worm drive, enclosed case system, a relatively liquid, mineral lubricant should be used which will be sufficiently adhesive to stick tenaciously to the teeth, resist the wiping action of the worm, and still be fluid enough to serve as a lubricant for the worm shaft, bearings and thrusts. With an open gear case, however, a comparatively inert lubricant should be used, with the added qualification of not dripping, or tending to be thrown off by centrifugal force.

The lubrication of electrical equipment such as motors, generators and exciters, will be confined solely to bearings, and will involve no difficulties as a rule. Generator bearings are usually lubricated by force feed or gravity circulation of the oil, frequently with connection to the system installed for the lubrication of the main engine. Motors and exciters, however, are usually independently lubricated, the bearings being built with some type of automatic, self-contained system as ring oilers or wick feeds. The former are chiefly used on larger equipment, wick feed being confined to smaller motors such as are used for driving process machinery in the plant. For electrical equipment either a turbine or straight mineral engine oil will be suitable.

The application of grease lubrication to power plant equipment is regarded by many authorities as a special subject. There are certain classes of operating conditions where greases are decidedly adaptable; on the other hand, in the majority of cases fluid lubricants will predominate. Greases are generally used in cases where oil is not adaptable. Slow moving bearings, or equipment located in inaccessible places, are often grease lubricated.

How Much Material are your Conveyors Handling?

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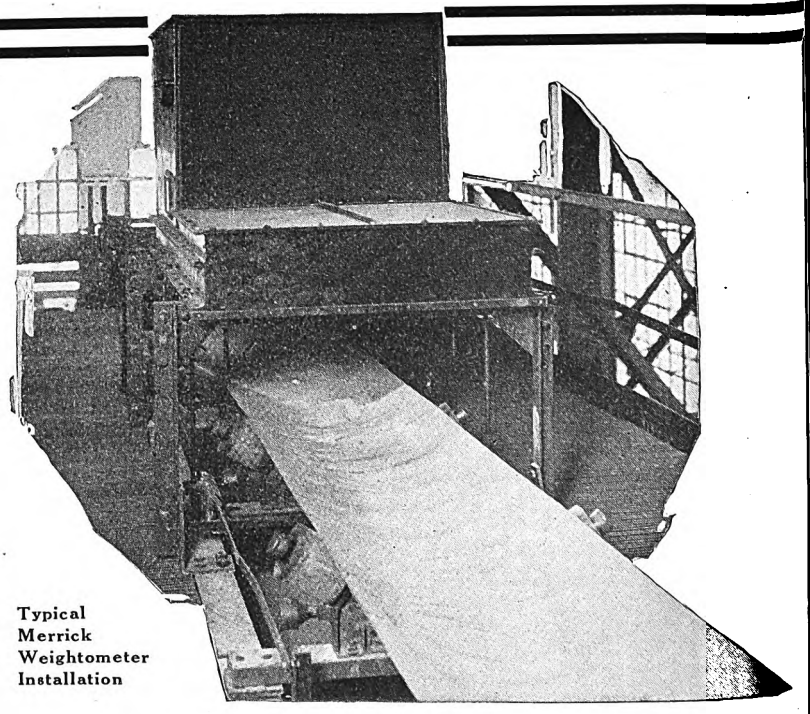
If not, you need a Merrick Weightometer, which weighs all conveyor handled material—coal, sand, coke, stone, gravel, rock, pebbles, wood chips, etc.—while in transit, and enables you to know exactly how much is being or has been transported.

As a precautionary measure enabling you to check the materials or products you buy and sell, the Weightometer is invaluable. It tells you exactly how much you receive, how much you ship, or gives you a check on mill operations.

Easily installed, the Merrick Weightometer requires no operating expense because its action is entirely automatic; no attendant being necessary. Materials are weighed and results recorded as they are carried along on the conveyor without the flow being interrupted or retarded.

Hundreds of concerns no longer rely on bills of lading to ascertain weights. The Merrick Weightometer being guaranteed to 99% accuracy gives them the information they need without delay and without the possibility of mistake.

We'll gladly send "Merrick Circulars" showing types of installations, without obligation. Send for them.



Typical Merrick Weightometer Installation

MERRICK SCALE MFG. CO.

180 Autumn St., Passaic, N. J.

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Systems and Application of Pneumatic Conveying

(*Continued from page 25*)

4. The distance over which the material is to be conveyed.
5. The difference in level between the point at which the material is fed into the system and the point where it is delivered.
6. The method and regularity of feeding the material into the system.
7. The method to be adopted for separating the materials from the conveying air at the desired point of delivery.

After consideration has been given to the above points, pneumatic conveying systems naturally fall into two main classes, the pressure or blowing system, and the vacuum or suction system. There is a very important difference between plants in which the materials pass through fans or blowers, and those in which the conveying is carried out entirely under suction. In recent years, the vacuum system, including most of the examples cited here, has taken the lead. The two main classifications mentioned above have three sub-divisions, each depending on the pressure under which the system operates. The complete classification is:

Vacuum systems—low, medium, and high.

Pressure systems—low, medium, and high.

The low pressure or the low vacuum systems are, with few exceptions, used in dust collecting work, and are mentioned here merely to make the outline complete. These systems are used, in certain cases, for conveying sawdust, shavings, wool, feathers, and similar light materials, and operate with the pressure or vacuum of 6″ to 10″ of water. A comparatively large air volume is required, ranging from 30 to 70 cu. feet of air per pound of material handled, depending on the nature and weight of the materials, and the distances over which they must be conveyed. Fans are generally used for this work.

The medium pressure and medium vacuum systems have been used extensively for many years, especially for handling grain and similar materials. Rotary blowers or vacuum pumps supply the energy, and 4″ to 10″ of mercury is the pressure or vacuum used. In general design these systems resemble the high pressure and high vacuum systems. However, as they use a large volume of air, they also use larger pipe lines, and collecting stations, than do the high pressure systems. From 3 to 10 cu. feet of air per pound of material handled is the amount required, depending on the nature and density of the materials handled, and the distance the material is moved. They will handle, however, the same materials as the high systems, subject to certain disadvantages, which will be pointed out later.

Insofar as the equipment is concerned, the high pressure system is the simplest of all. It consists of a high pressure blower, a pipe line, and collector. The material can be fed into the pipe line either through a specially designed feeder or through an ejector. When materials containing little or no dust,

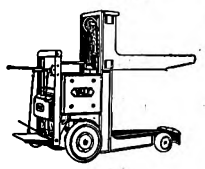
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Chapter 4 on Storage Battery Trucking



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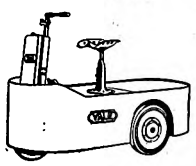
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A new standard of Industrial Truck Values

The "K" model Yale Industrial Trucks are so designed and built as to permit of such definite manufacturing and operating economies that a *new standard of values* has been established for this type of vehicle.

A concrete example will best illustrate this fact.

The Yale Spur-Geared Power Axle is one of the major units interchangeable between all of the trucks in the new "K" series. This means that "K" trucks are so built that the Power Axle can be taken out of one type and put into any of the others in this series.

This means that the cost of manufacturing and assembling Yale Power Axles is greatly reduced since only one type is made for all "K" trucks. This same idea of interchangeability of parts has been applied throughout the entire series with the result that the lowest possible prices have been attained for these Yale quality products.

This automotive method of manufacturing and assembling so simplifies the building of Yale "K" model Industrial Trucks that their cost is reduced to a minimum, without in any way lowering Yale standards of mechanical excellence.

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for Vertical Travel
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such as grain, wheat, wood chips, whole pepper or the like are to be handled, the materials can simply be blown through the pipe line into a cyclone, or directly into a bin or warehouse. This is illustrated on the right side of figure 6.

Where, however, dusty materials such as soda ash, plaster of Paris, cement, etc., are conveyed, the equipment must include in addition an air filter to prevent the dust from being carried away with the escaping air, thus eliminating waste and nuisance. This is illustrated on the left side of figure 6. The use of this pressure system is in practice generally limited to where the materials to be conveyed can be fed into fixed receivers at stationary points, therefore the rapidly increasing use of pneumatic conveying in late years has been mainly of the high vacuum type. When this system is employed, a flexible feeding hose is used, and pipe lines can be run from the same collecting station to various points, permitting greater flexibility and hence adaptability. A composite and diagrammatic layout of this system is shown in figure 7.

During the years 1916 to 191[illegible] it became extremely difficult [illegible] get materials for sacks. For this reason such products as cement, soda ash, gypsum, lime, etc., very often had to be shipped in bulk in box cars. This practice has now developed from an emergency measure to a common method of shipment, because of the economies which its effects. Shipping in this manner, however, presents a very difficult unloading problem, but the need for an economical unloading device was met, and pneumatic conveying systems are now being successfully employed on these operations.

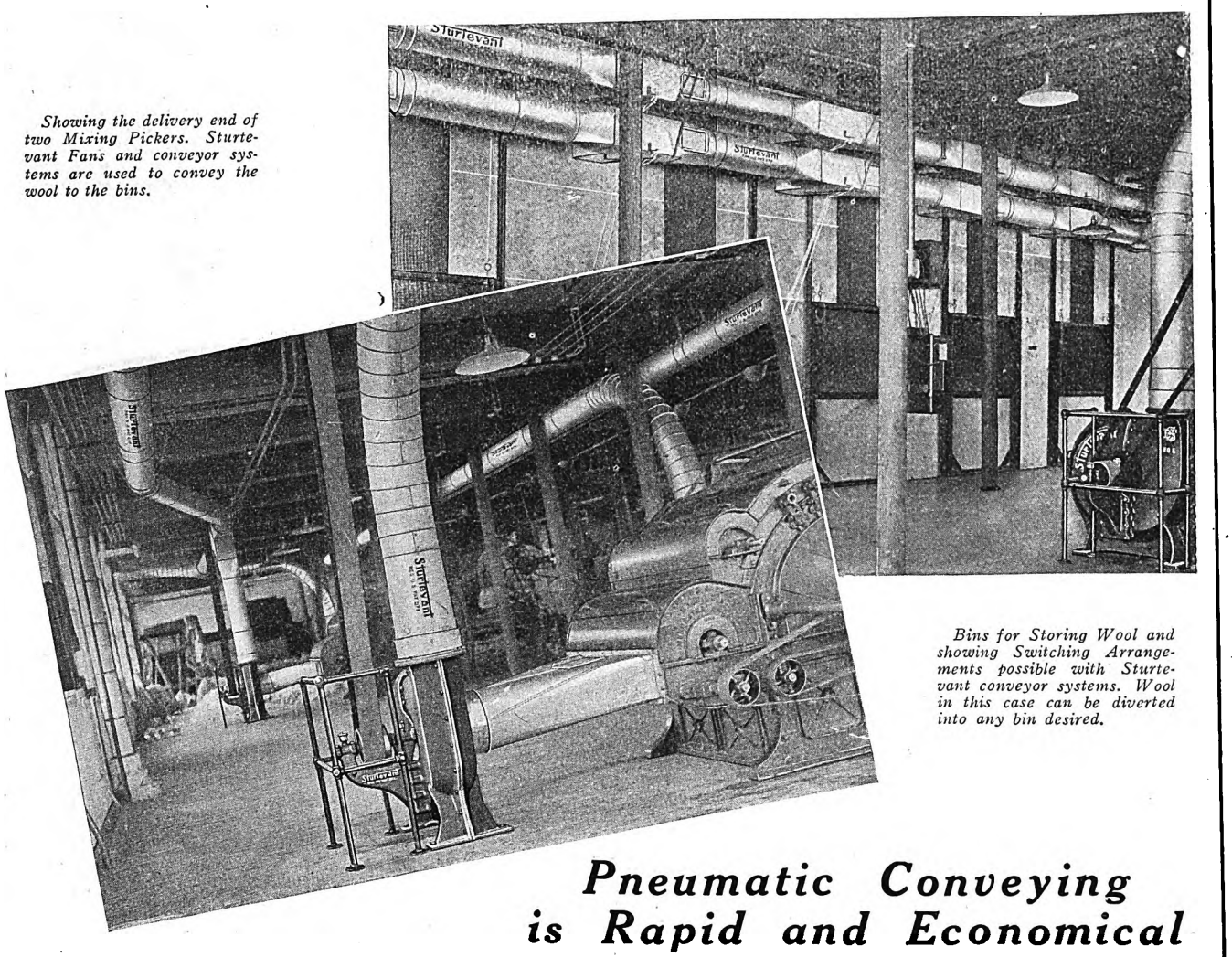
When mentioning the subject of car unloading, we touch immediately on the essential difference in the adaptability of the medium vacuum system in comparison with the high vacuum system. With the medium vacuum system, an air volume of from 3 to 10 cu. feet per pound of material is required with a vacuum of 4 to 10″ H.G. This necessitates (to show by concrete illustration) using a 10″ pipe and suction hose, for unloading 20 tons per hour from a car, conveying material a distance of, say, 150 feet, using an air volume of 4,000 cu. ft. per minute, and with a vacuum of 4 to 10″ H.G.; while under the same conditions and with the same capacity and distance, the high vacuum system would require only 1600 cu. feet of air per minute, at 16 to 17″ H.G. vacuum, and only a 4″ conveying pipe and hose.

It will be very easy for everyone to understand the difference between handling a 10″ heavy suction hose in a car and a 4″ hose, the difference being that the first is nearly impossible and the other is thoroughly practicable.

What applies to hose also applies, of course, to pipe lines and size of dust collecting stations and dust collectors.

It is apparent that a small pipe line is easier to erect almost anywhere than a large cumbersome line.

The high velocity and vacuum used have made it feasible to convey the heaviest known materials as well as the lightest, and systems of this type are actually handling such materials as metallic lead from atomizers which weigh from 450 to 500 pounds per cu. foot, and such materials as talcum powder, car-



Showing the delivery end of two Mixing Pickers. Sturtevant Fans and conveyor systems are used to convey the wool to the bins.

Bins for Storing Wool and showing Switching Arrangements possible with Sturtevant conveyor systems. Wool in this case can be diverted into any bin desired.

Pneumatic Conveying is Rapid and Economical

Sturtevant Pneumatic Conveying Systems are largely used on materials, such as:

Wool, cotton, hair, flax, hemp, jute, rags, shoddy, chips, cork dust, shavings, waste paper, pulverized fuel, jute bagging, grain seeds, coffee, cereal, wood or paper pulp, tan bark, etc.

Sturtevant Dust Collecting Systems are also made to meet the needs of many industries in coping with the hazards and unnecessary costs of accumulating dust, waste and refuse.

The Sturtevant Pneumatic System of conveying materials is one that is extremely rapid and economical, avoiding much labor in handling material, eliminating hand trucks, occupying no valuable floor space, and protecting the product while in transit.

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on black and powdered coal. It will be noted from the various layouts that at the base of the receiver there is a rotary discharge lock which dumps the material into the storage bin (a general view of this lock is shown in figure 8). The rotary lock greatly hampered the development of pneumatic conveying systems. It was necessary for this rotary lock to be tight, so as to maintain the vacuum or pressure in the conveying line, but due to the wear on the surface of the rotating drums, there was more or less leakage, thus reducing the efficiency of the system.

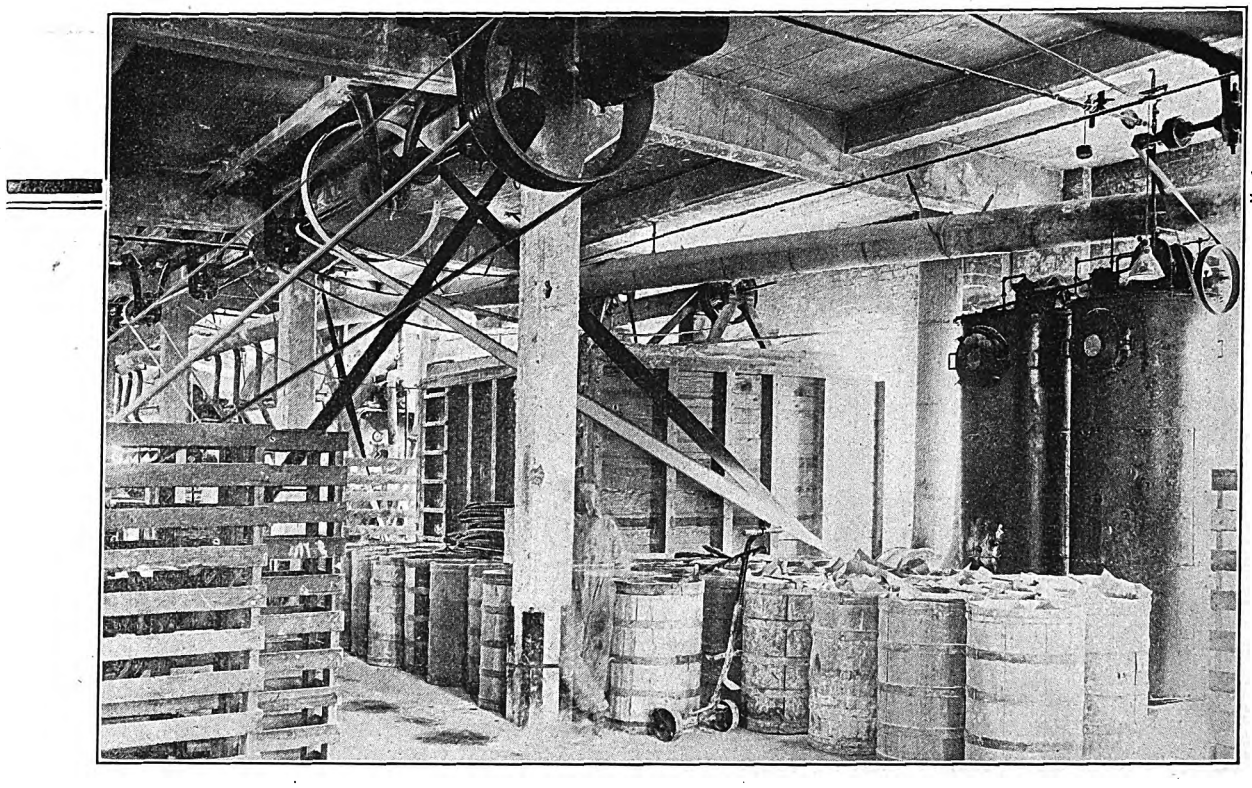
Another difficulty was the choking of these locks by large pieces of materials becoming wedged between the drum compartments and the casing. In order to overcome this deficiency, a multiple stage air lock has been designed, operating on an entirely different principle, permitting the large pieces to pass through, and because one of the stages of the lock is always closed, there is absolutely no leakage of air while the other two are discharging. The regulation of this lock is entirely automatic and self contained, and a general exterior view is shown in figure 9. The development of this lock is now making possible for pneumatic conveying systems to handle materials that a few years ago presented serious problems, due to their effect on choking or injuring the more common rotary type dischargers.

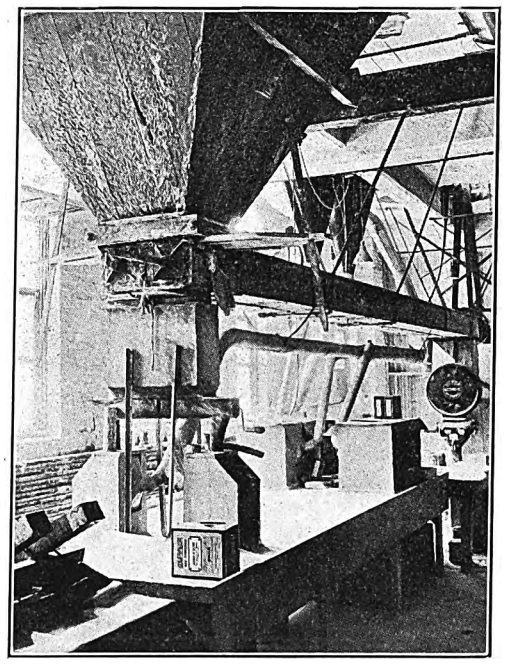
There has also been great improvement in the filters which clean the air of all dust particles before it reaches the fan or blowers. A complete installation of vacuum pump filter and simple rotary air lock of American manufacture is shown in figure 10. Note the compactness of the equipment, and the small space that it occupies.

Figure 11 is not presented as a comparative example of British equipment, but is used to illustrate the difference between American and British design. It shows the vertical vacuum pump, filter and air receiver, but the equipment is not an actual installation. The picture was taken in the shop before shipment. To obtain a clear view of the diagrammatic layout of British manufacture, we will look at figure 12, which shows the arrangement of a combined coal and ash plant at the works of Messrs. Wardell & Davenport, Leeds. In this plant the coal is discharged into an underground bunker, and elevated from same into the overhead bunkers above the boilers. When the plant handles ashes from the ash tunnel, the underground bunker is emptied of coal and the ashes put into the same. After the clinkers are broken to a suitable size, passing through the grid, they are passed through the same discharger as the coal, and gravitate down the chute to the ash cart below.

In this case, the manufacturers found that the ordinary form of discharge valve such as was used for coal and grain, could not be used for ashes, owing to the abrasive nature of the material, and it was therefore necessary for them to design an automatic discharge valve which had no wearing surfaces. This has proved so satisfactory that they are now using it for all classes of materials, and have eliminated the common rotary valve formerly used.

This valve of British manufacture is an improvement and





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shows that foreign countries are also investigating the more extensive use of pneumatic conveying and developing new air locks along entirely different lines from that shown in figure 9. In this same figure, an interesting point to note is the vertical vacuum pump, of which very few are in service in this country.

Considering that pneumatic conveying is now becoming of international importance, it is a subject that deserves a great deal of study and attention, and the following installation diagrams and photographs, both of American and British manufacture, will show some of the successful installations which are now in operation.

Figure 13 shows the plan and elevation or general arrangement of the coal handling plant at the works of the India Rubber & Gutta Percha Co., Ltd., at Silvertown, England. In this plant, coal is taken from barge A and discharged into the main storage bunkers at points B and C. It is also taken from the main storage bunker and discharged to a belt conveyor at D, which distributes the coal to the bunkers over the boilers. Alternatively, the same plant is arranged to take coal from the railway trucks at point E and discharge it at point D to the belt conveyor for distribution.

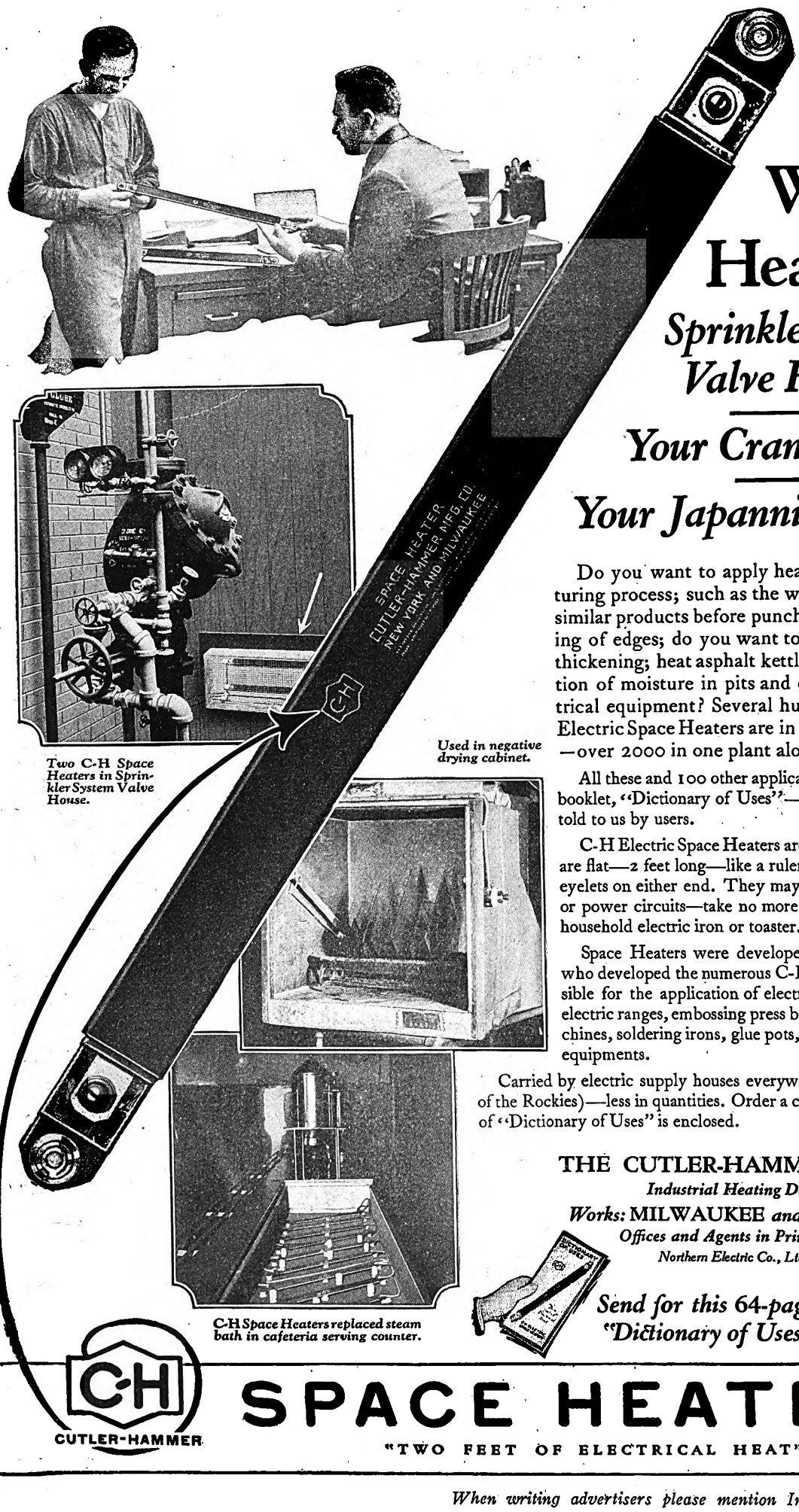
The vacuum pumps, dust collectors, etc., are arranged in position F. The capacity of the dischargers B and C is 20 tons per hour, and discharger D about 15 tons per hour.

It will be noted that the coal is conveyed for a considerable distance, and the air is also handled for a considerable distance when material is being lifted from point E to point D.

Figure 14 shows an American installation operating in a fertilizing plant. To the left is shown the warehouse, where crushed dry bone and bone dust are stored. The pneumatic conveying collecting station and pump are placed on top of the bone grinding plant, and the pipe line, with flexible hose, sucks the material from the warehouse at the rate of 20 tons per hour, and discharges either to screens or grinders. A second pipe line comes down inside the grinder building and passes into a dryer room, and this pipe line is used in carrying dry tankage from dryers to the grinding plant. When this installation was first installed, it reduced the labor costs by the wages of 2 men.

While considerable progress has been made, and possibly more compact equipment has been developed in this country, there are more extensive installations of pneumatic conveying equipment in England than here. One very elaborate installation is shown in figure 15, of a combined suction and blowing plant for handling dry brewers' grains which are used as cattle feed. In this plant a reciprocating pump may be used as an air compressor or vacuum pump. The dry grain is elevated by means of bucket elevators to the top of the bunker, and gravitates to a screw conveyor, which feeds it to the pneumatic conveying nozzle, connected to the blowing plant. From this point it is blown to the various floors of two buildings, and stored loose on the floors. In the winter time, when there is a demand for this cattle feed, the action of the plant is reversed, and suction nozzles are fitted on the pipe lines where required, and

(Continued on page 78)



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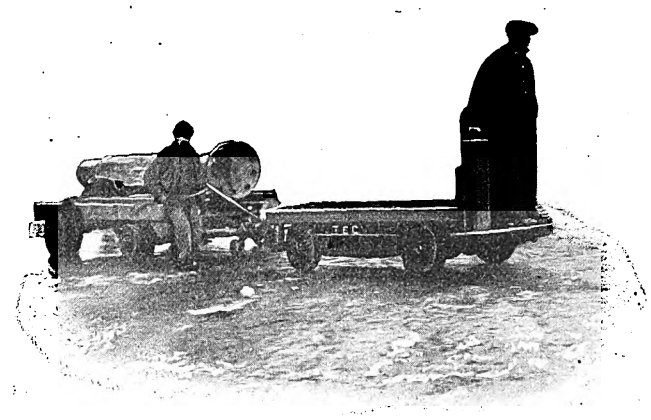
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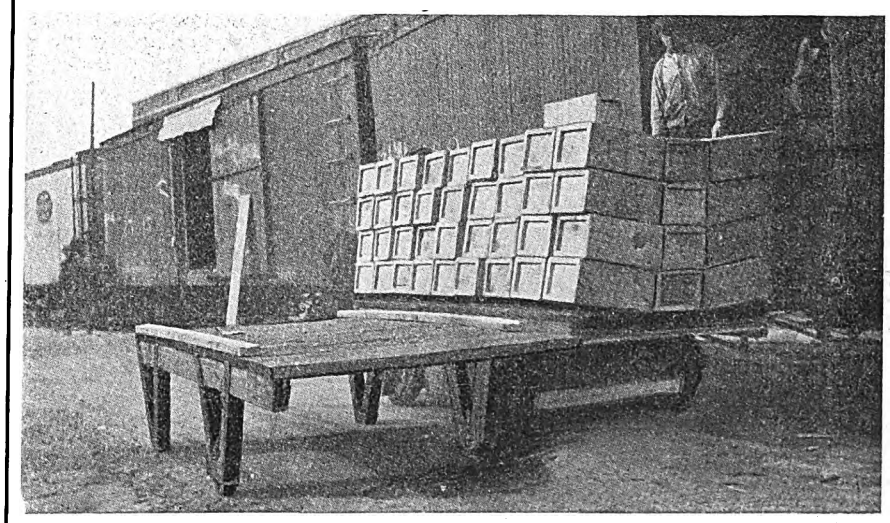
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(*Continued from page 76*)

grain is then drawn to a cyclone discharger, and discharged through automatic weighers into bag chutes. The capacity of this plant when either blowing or sucking, is from 8 to 10 tons per hour.

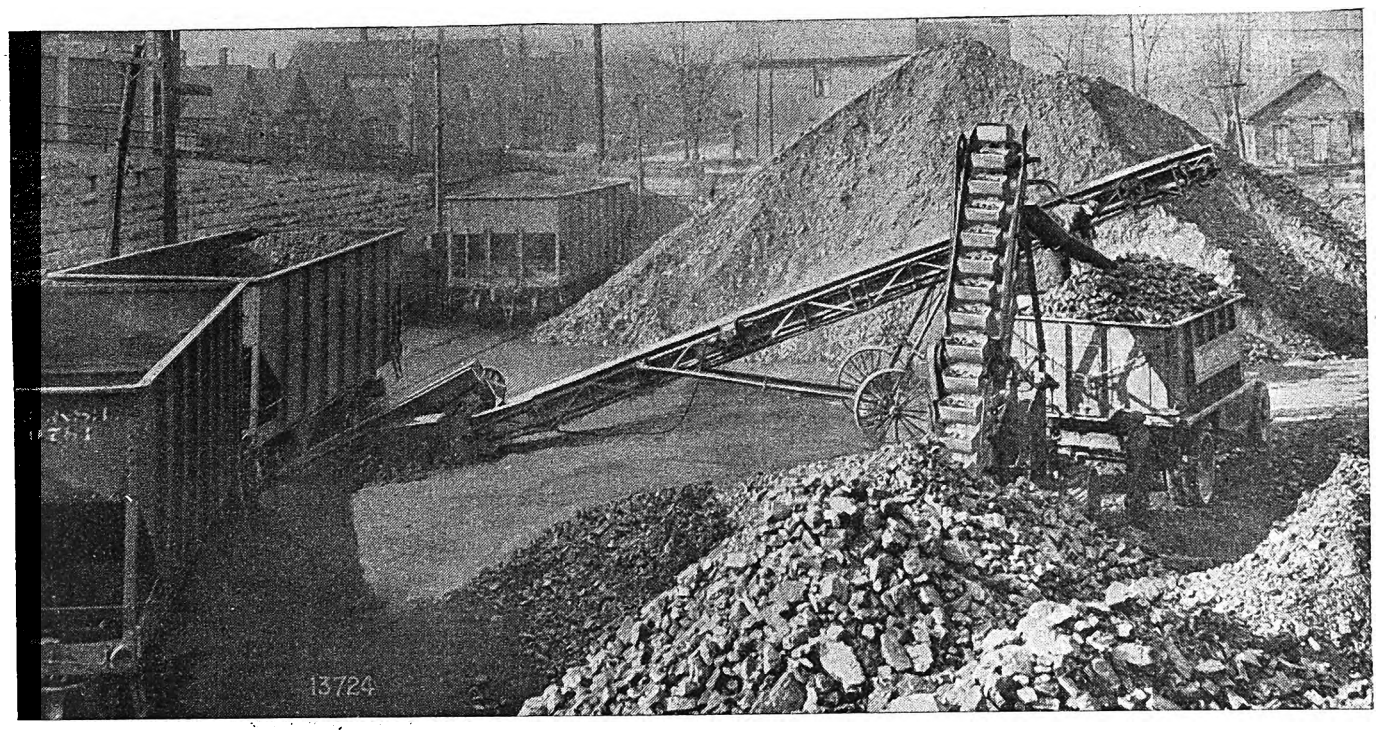
Another interesting American installation is shown in figures 16, 17 and 18, where a pneumatic conveying installation is being used to handle from 5 to 10 tons of arsenic per hour, according to the distance from the pump and collecting station to the settling chamber, which is being unloaded. Figure 16 shows the inside of the settling chamber, and the white material is arsenic. The conveying nozzle and flexible hose is attached to the pipe line shown in figure 17, which runs over the various doors of the settling chambers. The hose can be attached to any of the Y connections. A complete layout, showing pipe lines, dust collectors, and screw conveyor for carrying the arsenic from the discharge lock to the refining furnace is shown in figure 18. Arsenic handling has always presented a difficult conveying problem, but the installation of pneumatic conveyors has eliminated the problem entirely.

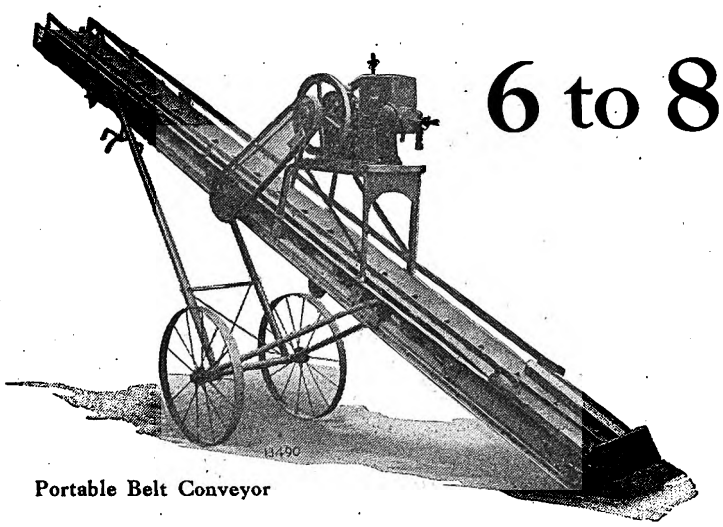
An instance where a great deal of waste, trouble, etc., presented itself was in connection with the removal of "blue fume" from flue systems in large lead refineries. This fume, as illustrations 19 and 20 indicate, had to be removed from a number of collecting hoppers, collectors, etc., scattered unsystematically all over the place. In the past, the operation consisted of tapping it to the ground, shoveling it into wheelbarrows, loading it into box cars, and then shipping it to other plants for re-treating. This was a very wasteful process, and nearly impossible on windy days. To collect this material with any type of mechanical conveyor, such as screw conveyor, belt, etc., was given up as hopeless, but a pneumatic conveying system permitted the placing of storage bins close to railway tracks and the storage bin was placed up high enough so that material would be discharged from same direct to cars.

Figure 19 shows plainly the conveying pipe lines passing on in three different directions, and the first part of one of these is shown running parallel with gas flue, and intake connections are located at suitable intervals for flexible hose with special material intakes, which latter can be placed under settling hoppers from where material is to be drawn. A continuation of this line is shown in figure 20, and the special intake and hose is plainly visible in the foreground. The blue fume is now carried through this pipe system, automatically, without traces of dust loss at any point, without labor or trouble of any kind, to the collecting station, and is automatically discharged into bins and is easily loaded to cars for shipment.

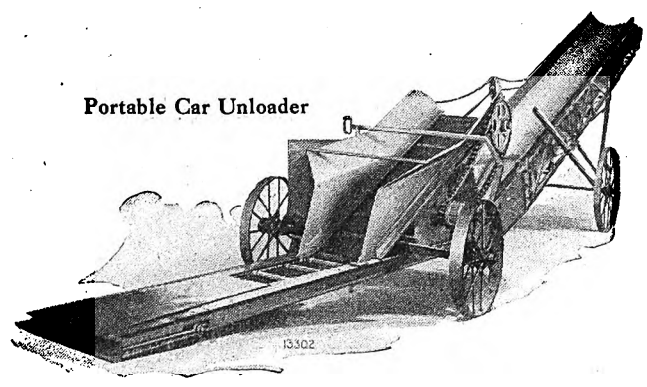
While most of the material previously mentioned is of a fine pulverized nature, it does not necessarily mean that this is the only class of material that can be conveyed pneumatically. Figure 21 shows actual size of phosphate rock now being handled in a 4" diameter hose at the rate of 30 tons per hour. Figure 22 shows how the nozzle is placed in the material, and how the pile gravitates to the nozzle as the unloading ad-

(*Continued on page 80*)





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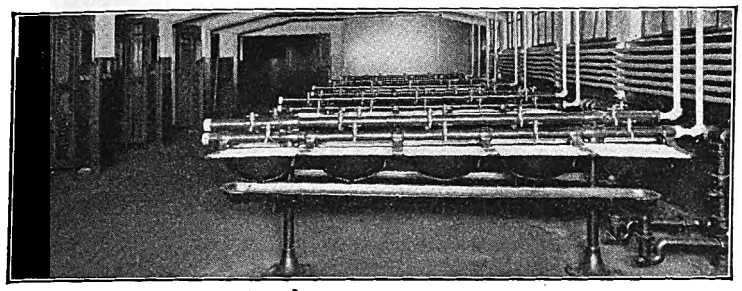
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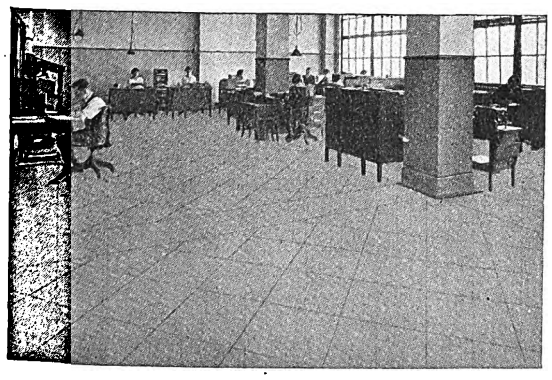
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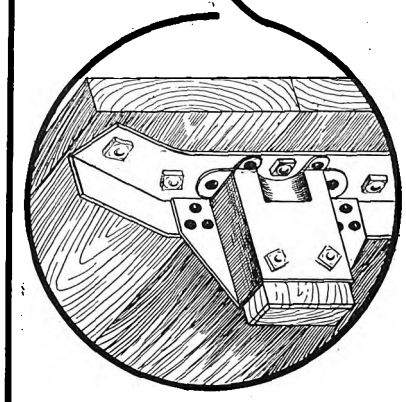
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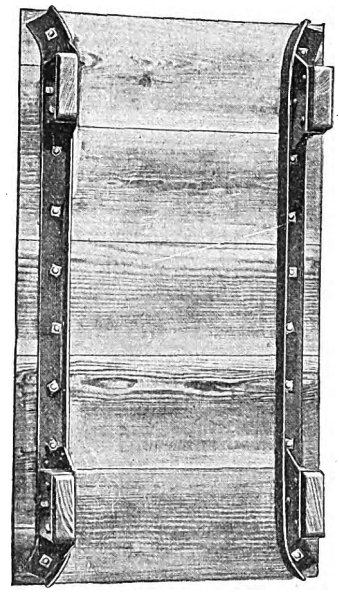
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(*Continued from page 78*)

vances. It is only necessary for the man to keep the nozzle submerged in the material, and he is not required to do any shoveling or cleaning in order to unload the barge entirely.

Although considerable progress has been made, and undoubtedly more compact equipment has been developed in this country, there are more extensive installations of pneumatic conveying equipment in England than here. The apparent reason for this seems to be that the existence of old buildings and plants in that country does not adapt them so well to the installation of other types of conveyors, consequently the plant executives have gone further into the investigation of the value of pneumatic conveying, thus encouraging the manufacturers of the equipment.

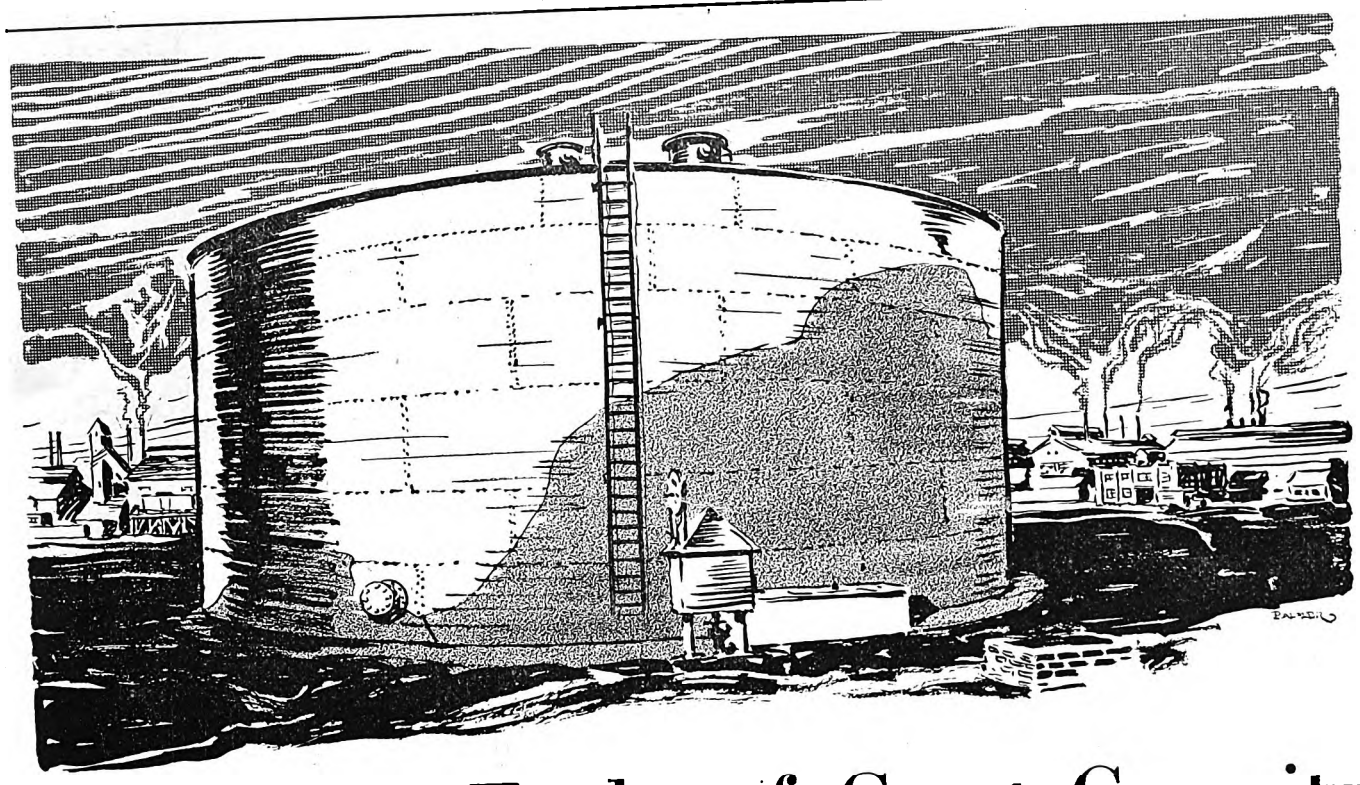
To illustrate this point, we are showing a floating pneumatic transfer plant, for transferring grain from ship holds to barges. Grain especially lends itself admirably to pneumatic conveying, because it is easy in flow, regular in size, and practically self-feeding. This possibly has much to do with the large tonnage which can be handled by this plant, namely, 200 to 250 tons per hour. The diagram is self-explanatory. To the left is the ship which is being unloaded, while to the right is the barge which is being loaded and between the two is the transfer plant. A represents the special suction nozzle through which the grain enters the system, together with the free air which acts as the conveying medium. B is the length of flexible hose to enable the nozzle to sweep the width of the barge, the length being dealt with by moving the boat to within the radius of the swivel arms. C is a permanent pipe carried on the jib arm, which is mounted on a swivel joint. D is another large flexible pipe to permit of the swivelling already mentioned. F indicates the receiver into which the grain is deposited, and G the special rotary valves for releasing the material from the system without interfering with the vacuum of the conveying line. J indicates the connecting pipes of the receivers, air filters and pumps, and it should be noted that they are considerably larger than those on the suction end, C; this being necessary to allow for the expansion of the air under vacuum. K is the reciprocating pump driven from a power engine, M, through large helical gear wheels which act as fly wheels and help in equalizing the torque required by the pump. L is the outlet pipe for the air as it is exhausted from and by the pump.

This plant is simple, but every possible modification can be added that circumstances may render desirable, such as discharging to a belt conveyor for feeding the silos or other storage points.

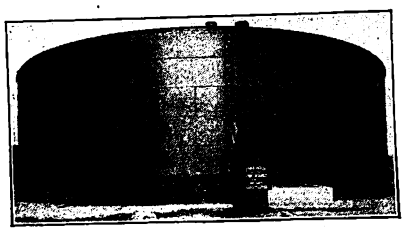
The pneumatic system of transportation has many advantages over mechanical conveying. These may be summarized as follows:

Economy in labor; flexibility in plant, both in design and operation; elimination of dust and its harmful effect on the employees, and in many instances the recovery of dust which is valuable and which would otherwise represent a serious financial loss; wear and tear on moving parts is reduced to a minimum; all obstacles such

(*Continued on page 82*)



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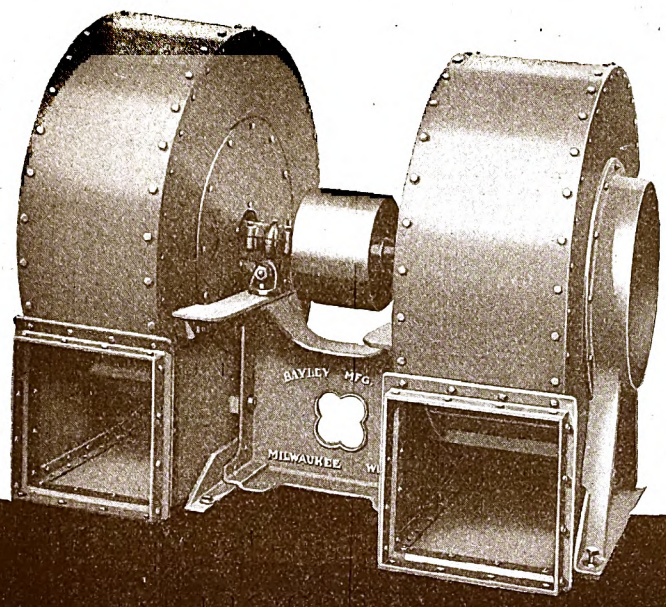
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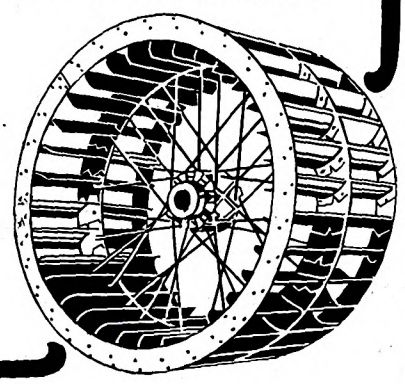
Economical Ventilation

Next to efficiency, economical operation and durability are the most important requirements of any mechanical ventilation system.

Bayley

Plexiform Fans

meet all of these requirements and are in addition designed to occupy a minimum of space. Light, yet sturdy and durable, easy running, moving the greatest volume of air with low power and upkeep costs are a few Bayley Plexiform features. Made in various sizes, either single or double mounts, with outlets in any desired position, for engine, motor or lineshaft drive.



Write for booklet

Bayley Mfg. Company, Dept. P
Milwaukee, Wisconsin

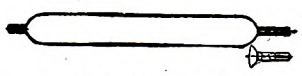


SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Whenever rollers are used, Conveying Systems, Steel Mill Tables, and the like, maximum neck-strength is required because here the strain is most severe. Wharton rollers are made in one-piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained.

Yet, because they are hollow they are light in weight—saving in freight—easy to handle—lower power cost. Built only on order to meet customers requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.



Cross-Section Showing
Hollow Construction

Wm. Wharton Jr. & Co., Inc.
(Founded 1859)
30 Church Street, New York, U. S. A.
Cable, Whilwharton, New York



P & H Cranes

SINCE the first three-motor electric traveling crane was built—in the P & H shops 30 years ago—there has always been one big outstanding feature—Dependability. And this applied to both the product and the company. P & H Cranes and Hoists—(over 7000 in use)—stand up under the most severe and continuous service, whether in steel plant, foundry, railroad shop or other industrial plant.

We are firmly convinced that there is no crane in the world capable of steadier, more dependable performance.

P & H quality of design and construction—the care in selection of all materials—such extra efforts as the re-rolling of all plates in our own plant—our "renewal from stock" service—and standardization—insure the added service and dependability that you get when you buy P & H Cranes.

The fact that the buyer never needs to justify his selection is an indication of how the industrial man and engineer look upon P & H Cranes.

Crane and Hoist Division

PAWLING & HARNISCHFEGER CO.
Established in 1884
3850 National Avenue, Milwaukee, Wis.

New York
Pittsburgh
Phoenix
Los Angeles
Salt Lake City
Chicago
Philadelphia
Denver
San Francisco
Portland
St. Louis
Birmingham
New Orleans
Atlanta
Seattle

P&H CRANES and HOISTS

If we would save you 50% on the cost of the soap

used in your employees' wash rooms and would prove it to you, and at no expense to you whatsoever, it would interest you, wouldn't it? We can.

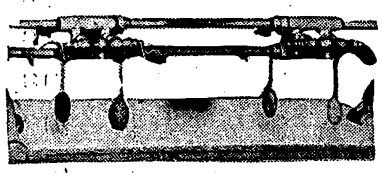


This type is by far the best for this style washstand, but requires a 9-16" hole to allow the weight to hang below in order to permit the soap to be carried to the water.

Having by far the most economical method for the using of toilet soap in your employees' wash rooms our only desire is to have you afford us the opportunity to prove it for you which we will do by sending you fixtures to equip your wash room and with them send a sufficient quantity of soap to give it a thorough trial and this trial will cost you nothing—neither will it place you under any obligation to us whatever.

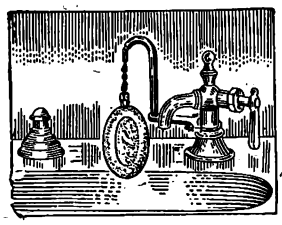
As a trial will be more convincing than all the sales talk we can advance, just write us how many fixtures you desire and we will send them with soap at once.

One of many types



This style is fastened to either the faucet or pipe, and if used on pipes as per cut place it close enough to faucet to allow soap to be carried under the water when in use and far enough away so soap will escape flow of water if left running.

Another type



This style just clamps on faucet and does not need plumbing in the least and is very easy to install and take off but soap does not pull down as the sliding chain does.

We manufacture fixtures to meet any condition and style of wash bowls and they are leased free for the using of our soaps which are the Antiseptic Cream, Ambro Pumice and Tar.

Write today for full details

ANCHOR CORE ECONOMY SOAP CO.

136 West Lake Street, Chicago, Ill.

(*Continued from page* 80)

buildings, roads, rivers, railways, etc., are all overcome easily, since the conveyor is "only a pipe."

Should circumstances not permit of a straight single run for such appliances as bucket elevators, screw conveyors, etc., plant executives would do well to consider the use of pneumatic conveyors, because the pipe is simple to install, and it can be carried up or down, around corners, over or under roads, etc. Cranes, hoists, telphers, belt conveyors, all have their special sphere of usefulness, but no other method can claim all the advantages of the pneumatic system as outlined above. Enough has been said to show that pneumatic conveying has made great progress and that the possibilities of this method of dealing with the moving of solid materials are much greater than has been generally recognized.

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

WHAT PAINT MEANS TO MAINTENANCE

Willard C. Beach Air Brush Co.
Debevoise Paint Co.
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Pratt & Lambert, Inc.
Sherwin-Williams Co.
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SYSTEMS AND APPLICATION OF PNEUMATIC CONVEYING

Allen & Billmyre, Inc.
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MAKING LABOR APPRECIATE THE LABOR-SAVING IDEA

The Cleveland Crane & Engineering Co.



Guarding everything but —the big thing!

ONE manufacturer has said that he looks upon his boiler room as a separate factory where coal and water are the raw materials and steam is the finished product. Is it necessary to add that his furnaces are equipped with mechanical stokers?

This man has felt the inconsistency of keeping the materials used in manufacturing in an orderly stock room where the smallest odds and ends can be had only with a properly signed requisition—and then in square contradiction of this policy of efficiency, allowing ton after ton of coal to be thrown into furnaces without a thought about how much is wasted.

An installation of mechanical stokers, and the expert engineering counsel that is a part of every stoker installation, deals a death blow to the old order of burning coal regardless of the savings possible.

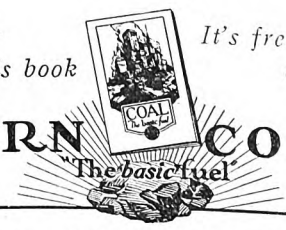
The great economy of fuel, the saving of labor, and the centralizing of responsibility in a few well trained men, invariably puts the stoker-fired power plant on a business basis.

It becomes a real productive department instead of the profit-dwarfing item of overhead that it was when the plant was hand fired.

Why stoker firing pays—why coal is the logical fuel and how to burn it—is the subject of a free book, "Coal—the *Basic* Fuel." Where shall we send it? A card addressed to the secretary of the association brings a copy to you.



Write for this book — *It's free of course*



STOKER MANUFACTURERS ASSOCIATION

G. A. Sacchi, Secretary, Lester Branch, Philadelphia

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Building 50,000-Horsepower Turbo-Generators

(*Continued from page* 18)

of the building, the two side bays having first and second mezzanines.

Standard gage railway tracks enter the south end of the east and west main bays, extending some two car lengths into the building and forming the shipping points. Narrow gage electric tracks enter the building at numerous openings on all four sides and cross all five bays from east to west at two places.

The main bays house the enormous tools required to machine turbine and generator parts (which may run in weight to forty or fifty tons and in diameter to as many feet). The main bays also house the test floors. In these two bays are 29,500 square feet of iron floor plates. The larger portion of these are erecting stands or test floors; the remainder are machine department floor plates where huge portable tools are brought to that work which is too heavy for economical transportation. The east and west side bays on the ground level are devoted to the machining of parts of more moderate weight and size, the east bay being particularly devoted to boring mill work on bucket wheel discs. A turbine may contain from thirteen to twenty-three of these discs, varying in diameter from four to eight feet and each turned from a solid forging of special alloy steel.

There are 987 machine tools in building No. 60 not counting small grinding stands and drill presses, and there are more than thirty-five overhead traveling cranes of capacity ranging from two to one hundred tons.

Some statistics regarding the size of a fifty thousand kilowatt unit may be of interest in helping the reader to visualize the scale on which operations are conducted. The turbine generator of this capacity has an over-all length of approximately 74 feet, a width of 24 feet and a height of seventeen feet above the floor line. The total weight of the steam turbine is 730,000 pounds, of the generator 441,000 pounds, and of the complete unit, 1,171,000 pounds or over 500 tons. The turbine shaft alone on a unit of this size weighs 27,000 pounds; the largest casting, the lower part of the exhaust hood, 85,000 pounds, and the rotating field of the generator weighs 205,000 pounds. The length of the rotor generator shaft is slightly more than 37 feet and its maximum diameter over the body 74½ inches.

Naturally in work as extensive as in building of huge turbine generator sets, information must come from the engineering department piece-meal. It is estimated that approximately twenty thousand individual sheets of drawings are required in a case of a fifty thousand kilowatt set, including of course the drawings for the various special nuts, bolts, fittings, etc. Many of these are standard and therefore do not require redesigning for each order, but nevertheless the steam, electric and vacuum conditions vary so greatly in different cases that a multitude of new drawings are as a rule required on each manufacturing order. The parts which take the longest time in their processing are naturally gotten out first

WORTHINGTON

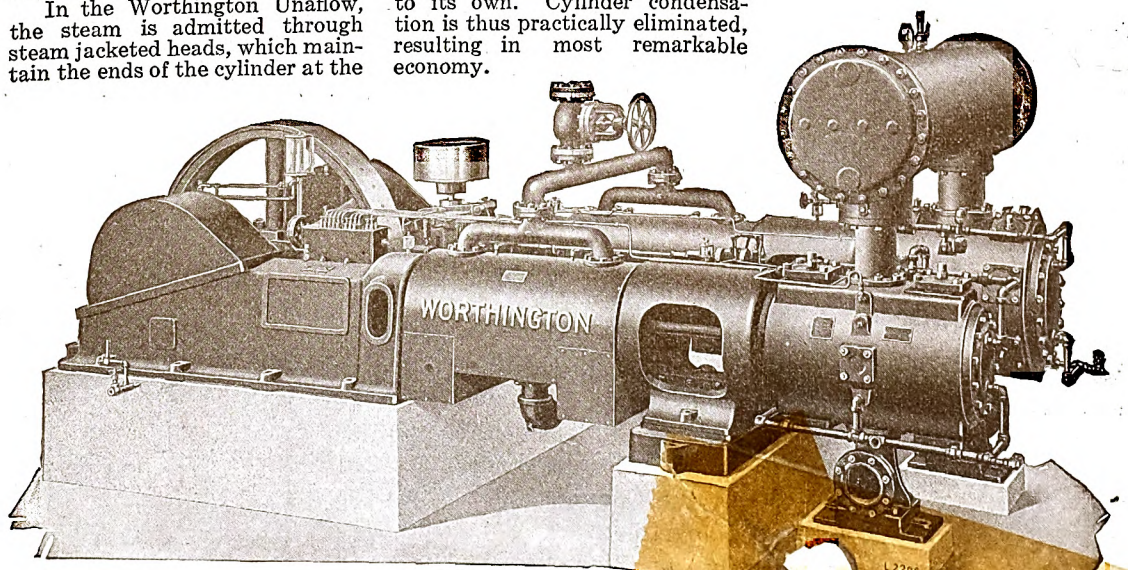
The
Unaflow Compressor
FEATHER VALVES
(Reg. U. S. Pat. Off.)
Unaflow Steam Economy

The Worthington Unaflow Air Compressor uses forty to fifty per cent. less steam than a slide valve machine and outstrips Meyer Gear economy by a wide margin. A 1,500 cubic foot capacity Unaflow compressor will save $775.00 in coal cost for one year as compared with the Meyer Gear. Certainly such savings are worth investigating. Bulletin L-542 tells the whole story.

UNAFLOW ECONOMY

Engine economy is largely a matter of reducing or eliminating cylinder condensation. In the usual engine, the steam counterflows, or travels back over its own path. Contact surfaces, such as heads, cylinder walls and ports are subjected alternately to live and exhaust steam, and as a result these chilled surfaces cause great initial condensation of the entering steam.

In the Worthington Unaflow, the steam is admitted through steam jacketed heads, which maintain the ends of the cylinder at the temperature of the live steam. The steam expands away from the cylinder head, and exhausts through central exhaust ports, uncovered by the moving piston. The steam does not counterflow, and thus the cool exhaust does not flow over those parts coming into contact with the entering steam. The entering steam is not chilled, but comes into contact with surfaces of a temperature quite equal to its own. Cylinder condensation is thus practically eliminated, resulting in most remarkable economy.

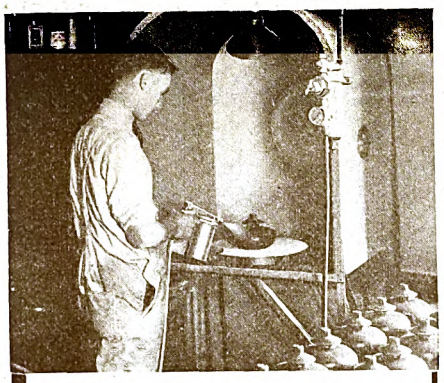


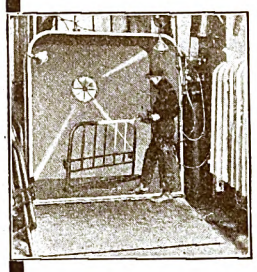
WORTHINGTON PUMP AND MACHINERY CORPORATION
Executive Offices: 115 Broadway, New York City. Branch Offices in 24 La

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WORTHINGT

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works
East Cambridge, Mass.
Worthington Works
Harrison, N. J.
Laidlaw Works, *Cincinnati, Ohio.*
Hazleton Works,
Hazleton, Pa.

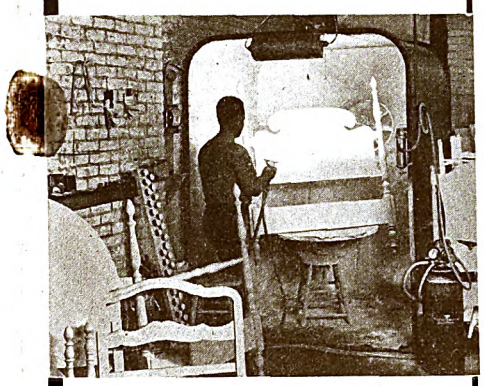


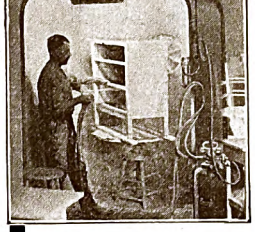


Save 3 to 5 Men

With SPRACO Industrial Finishing Equipment

Applicable to all kinds of surface coatings on all kinds of miscellaneous manufactured commodities.





Finer Finish!

Greater Speed!

Lower Cost!

Demonstrated and proved superior to all other finishing room methods.



Paint the "SPRACO" Way

Use SPRACO Portable Equipment for all upkeep work on Factory interiors and exteriors. Saves wk weeks in time. Saves thousand dollars in maintenance costs.

Write for SPRACO Bulletin of details and ... tive, de...

Y

g Co.

Boston, Mass.

CO

from the drafting room. The high pressure shell of a large unit requires anywhere from thirty-five to fifty weeks in the shop between its entry as a rough casting and its debut on the "steam date." The field shaft with its coils, retaining rings, etc., requires even more time. Information and drawings for such parts come first on the manufacturing instructions, while later additions, spread perhaps over a period of from four to six months inform the shop departments as to the identity and nature of other parts required in the unit which take less time to complete.

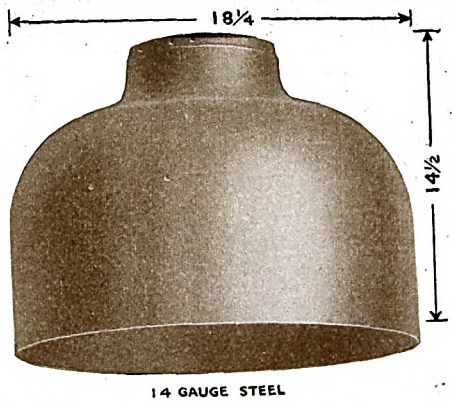
It is the practice in scheduling the production of the various parts of one of these large units to work back from what is known as the steam date, which as its name implies is the date set by the production office for the first admission of steam to the erected turbine.

For the past two years the sizes of the turbine generator units produced at Schenectady have grown larger and larger. A thirty thousand kilowatt set is today regarded as merely of average size, whereas two years ago it was a veritable monster. Today, fifty thousand kilowatts capacity is the average upper limit, although units have been built of slightly greater rating. The day of the 75,000 and 100,000 kilowatt unit is probably not far off.

Not only have the upper limits in capacity been thus extended, but the average sizes of all units represented by the work-in-process have become larger. Ten thousand kilowatts is approximately the smallest unit now built at Schenectady. Sets of less capacity than this made by the company are now being built at the Erie, Penn., plant.

As a commission from Governor Gifford Pinchot, a power survey of the state of Pennsylvania has just been instituted by the Commercial Engineering Department of Carnegie Institute of Technology. Dr. W. F. Rittman, head of the department, and Professor Sumner B. Ely are making the survey under the directorship of Morris L. Cooke, of Philadelphia.

The purpose of the study is to determine the approximate consumption of horse power necessary to operate Pennsylvania industries over a given period of future years.



Stronger and Lighter than Cast Iron---

Now Pressed from 14 Gauge Steel

This pump head was formerly made of cast iron. It is now Pressed out of 14 gauge steel. By turning this work over to us the manufacturer found that Pressed Steel Parts are stronger, lighter, look better and cost less than he could make them in his own plant. He is saving time and money and is utilizing his own equipment on more profitable work. Lower production costs and increased volume were gained.

Send us a sample or blue prints. We can show you how to effect similar economies and save you time and trouble by replacing forgings and castings with Pressed Metal Parts.

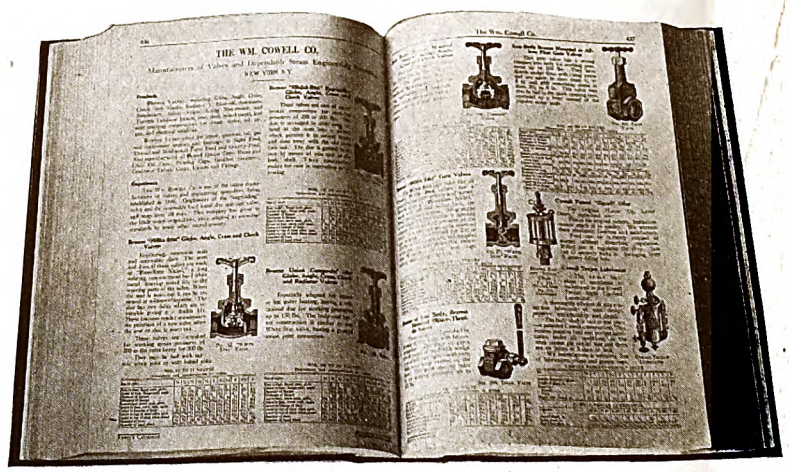
We have specialized for more than 42 years in this work.

We draw, stamp, punch, form, spin and blank the following sheet metals—Aluminum, Brass, Copper, Nickel, Zinc, Monel, Sheet Steel, Tinplate, Sheet Zinc, and we have facilities for electric spot and butt welding, hot tinning, hot galvanizing, japanning and porcelain enameling.

Geuder, Paeschke & Frey Co.

1457-1750 Canal St., Milwaukee, Wisc.,
352-358 W. Ohio St., Chicago, Ill.





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INDUSTRIAL and POWER PLANT MATERIALS and EQUIPMENT

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In This Issue

The Oxy-Acetylene Flame in Industry

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Industry Illustrated

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Two wheel trucks, four wheel trucks, trailers, lift trucks—all become Better Trucks when equipped with Hyatt roller bearings.

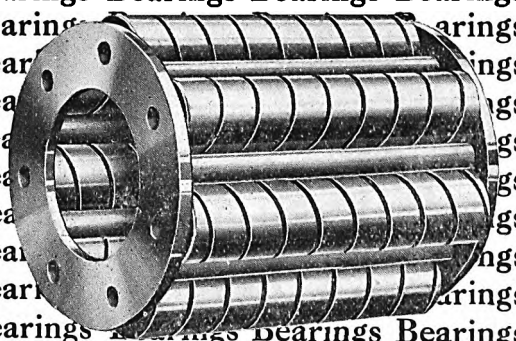
Better Trucks carry their loads easily, dependably and economically, their bearings — Hyatt roller bearings—last throughout the life of a truck without adjustment or replacement.

Better Trucks will cut your handling costs — specify Hyatt roller bearings and secure these economies.

Hyatt Roller Bearing Company

Newark Detroit Chicago San Francisco

Worcester Milwaukee Huntington Minneapolis
Philadelphia Cleveland Pittsburgh
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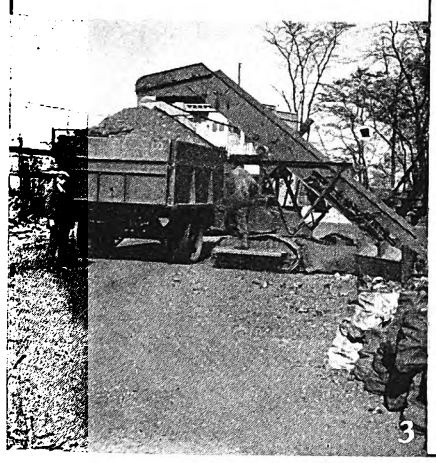


1.—*A Barber-Greene is used for auxiliary storage near the boiler room, at the White Motor Co., Cleveland. By storing the coal in a series of parallel piles, maximum storage is gained in a small space.*



2.—*A Barber-Greene unloading castings at the Cleveland Tractor Company's plant.*

3.—*Loading trucks from storage with a Barber-Greene Coal Loader, in the yards of a large coal company.*



A panicky market results when consumers' coal reserve falls to 20,000,000 tons.

20,000,000 tons

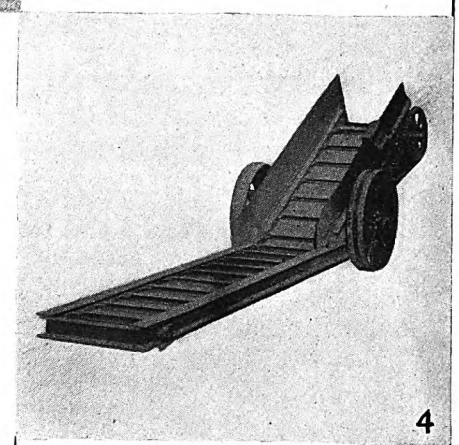
A 30,000,000 ton reserve still indicates a sellers' market.

30,000,000 tons

At 40,000,000 tons, salesmen go out after business on the consumers' terms.

40,000,000 tons

Send for our Coal-Handling booklet



4.—*The Barber-Greene Coal Feeder, used for unloading cars. The horizontal extension rests on the rails so that no pit is necessary. Roller chain is used both on the drive and to carry the flights.*

How Barber-Greenes are helping to maintain a buyers' market

"Consumers collectively have the power to make or break a market," says a recent report on coal storage. "The relation between the consumers' reserve and the price is almost mathematical. A reserve below 30,000,000 tons indicates a sellers' market; 20,000,000 tons indicates a panicky market; above 40,000,000 tons indicates a buyers' market."

Industrial consumers of coal find that advance storage is not only their soundest protection against plant shut-downs that too often accompany a coal shortage. It is also their one best means of maintaining a buyers' market.

And ample reserves are particularly advisable now. For they can be one of the strongest of all strike preventives this Spring when the present wage agreements expire.

But storage in any volume brings a difficult problem to many plants whose storage area is limited. If storing is done by hand, the area's capacity is soon reached. And it is a slow and costly method.

In cutting storage time and costs, and in multiplying the capacity of given ground areas, Barber-Greene methods have proved most successful.

Where four men could pile coal only 6 to 8 feet high, a Barber-Greene now stores it 16 feet high. At another plant a Barber-Greene increased the storage capacity of an area 600%, and reduced coal-handling costs from 68 cents to 12 cents a ton.

Our coal-handling booklet will throw interesting new lights on your own coal storage, reclaiming and handling problems. Send for it now.

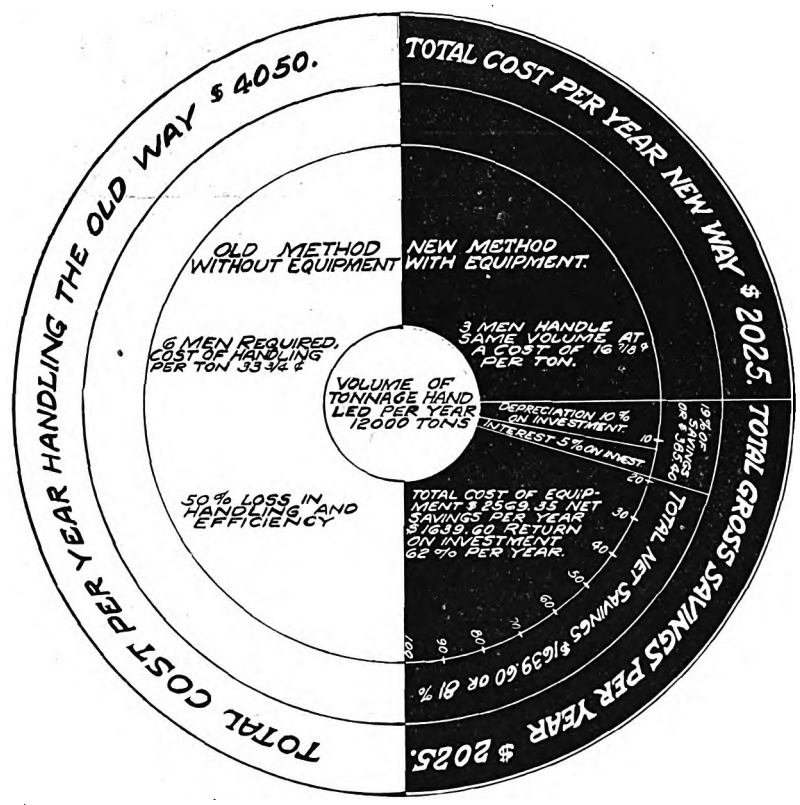
Barber-Greene Company, 500 W. Park Ave., Aurora, Illinois

Representatives in thirty-three cities

BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

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Handling Costs Cut 50%

The Graph above brings out the fact that W. F. Hall Printing Company of Chicago, now pay 16⅞ cents per ton in the handling of their products instead of 33¾ cents per ton which was the old cost.

It shows that on 12000 tons of printed matter a year this company saves $2025.00.

That on an investment of $2569.35 this company realizes a return of 62% net each year.

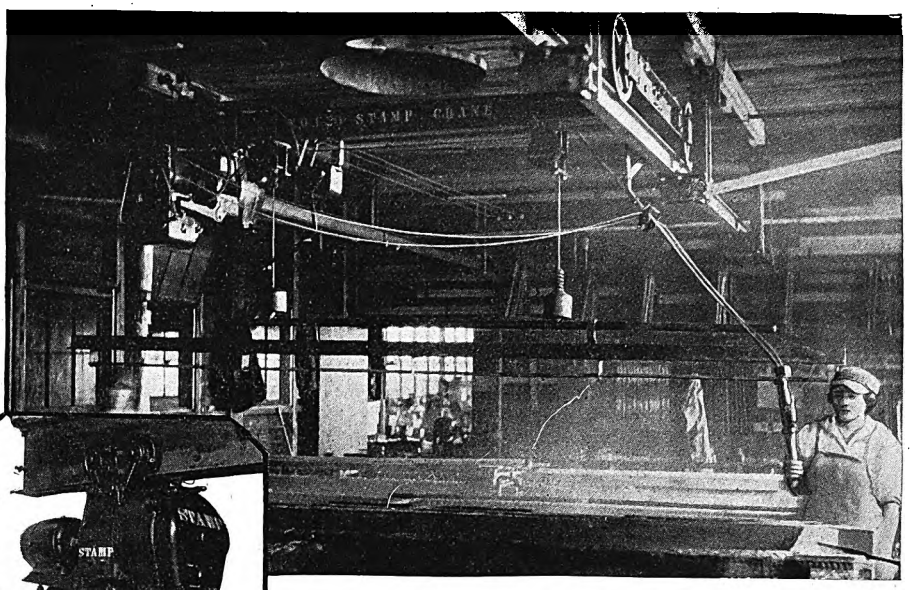
The equipment which brought about this saving consists mainly of a 6-story spiral chute connecting all floors with the shipping department and thereby speeds the handling and reduces the effort involved. Booklet S-2 showing this equipment will be sent on request.

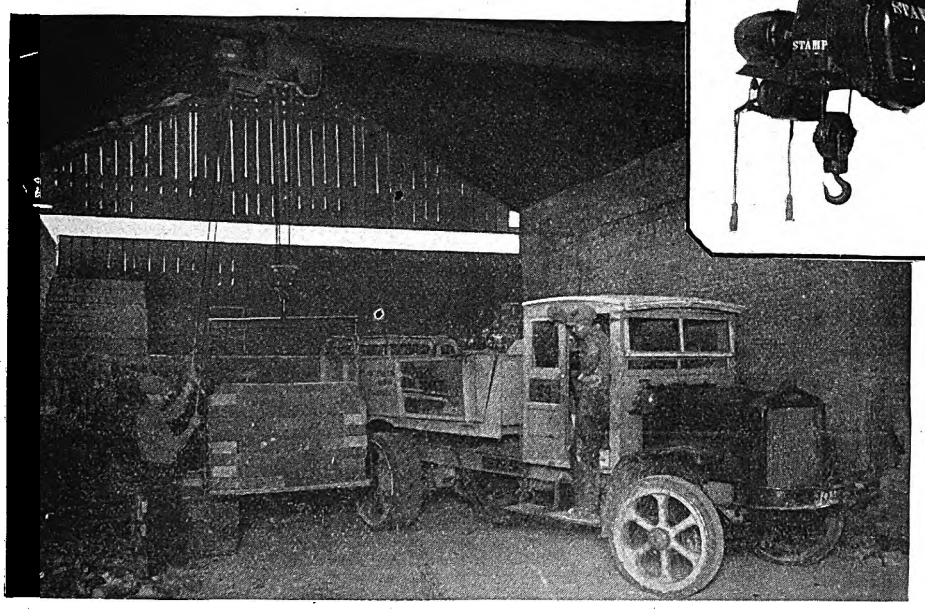
STANDARD CONVEYOR COMPANY

General Offices
NORTH ST. PAUL, MINN.
"Brown-Portable" Products Plant
NORTH CHICAGO, ILL.
REPRESENTATIVES IN ALL PRINCIPAL CITIES

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In Dust—Grit—and Acid Fumes





This Hyatt equipped Stamp hoist, used by a chemical plant, to and from a dipping vat, is constantly enveloped in acid fumes.

A one-ton Stamp hoist manufactured by the Stamp Electric Hoist Company, Cleveland, Ohio, embodying seven Hyatt bearings.

A Stamp hoist, equipped with Hyatt roller bearings, handling loads of brick from kiln to truck. Continually covered with brick dust and grit.

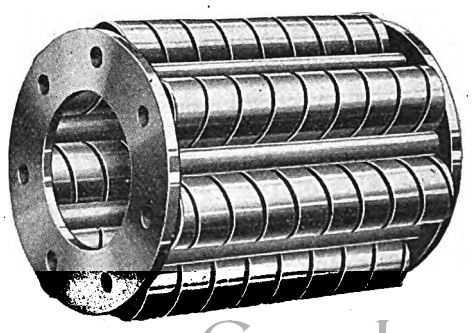
The efficient operation of Hyatt equipped cranes, trolleys and hoists is not hampered by the unfavorable conditions under which they work. These machines are fortified against any damage from the dirt and grit that settles on them.

The sturdy construction of Hyatt bearings enables them to withstand overloading and severe emergency duty. Even abuse and neglect at the hands of unskilled labor fail to cause any trouble. These bearings give smooth, uninterrupted service, year in and year out, without adjustment or replacement.

Even in the presence of acid fumes the efficient operation of Hyatt equipped handling machinery is not retarded. The distinctive features of the bearing housing and of the roller bearing itself insure complete and continuous lubrication. And it is only necessary to oil once every three or four months.

Hyatt equipped machines save operating power and labor, and speed up the work. The crane shown above as used in a chemical plant is operated through the entire working day by one girl, eliminating additional labor formerly required for the same work. The ease with which these machines may be moved and controlled makes them well adapted to use by girls.

Whatever the conditions under which your trolley, crane and hoist must operate, you will find that a Hyatt equipped installation will handle larger tonnage at lower costs.



Hyatt Roller Bearing Company

Newark Detroit Chicago San Francisco
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EFFICIENT HEATING
demands the JENNINGS PUMP

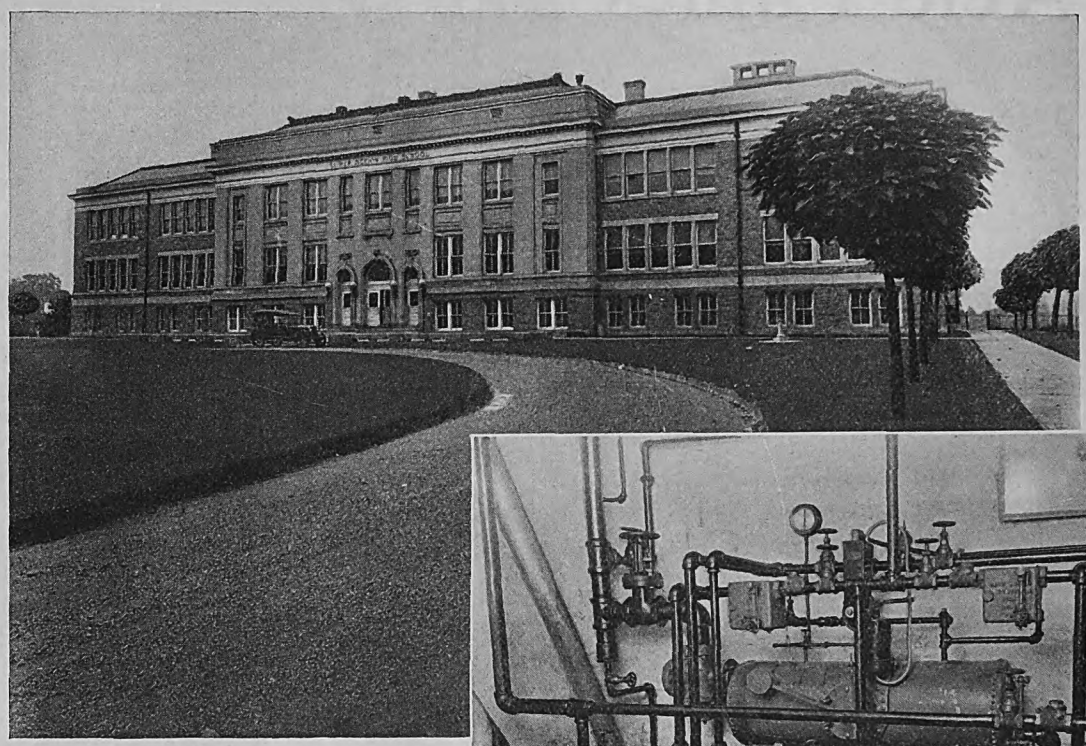
Trade Mark Reg.

Typical JENNINGS Installations

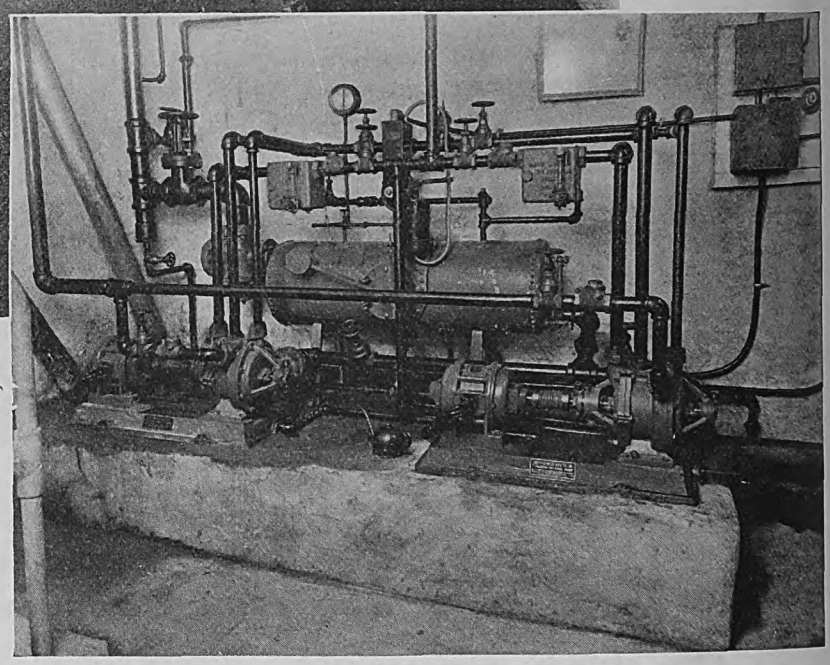
A Series

PHILADELPHIA

Independence Hall
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City Center Building
Corn Exchange National Bank
Ford Motor Company
Public Ledger Building
David Lupton Sons Company
Fayette R. Plumb, Inc.
Packard Motor Car Company
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Lower Merion High School
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Duplex "D" Unit
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Capacity each pump 40,000 sq. feet direct radiation, air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute. The motors are only 3 horse power.

No matter how well designed a Return Line Heating system may be, its satisfactory operation is largely dependent upon the proper functioning of the Vacuum Return Line Pump. The Jennings pump has proven on thousands of installations that it possesses the features necessary for proper operation under the most extreme conditions.

Jennings Return Line pumps are simple in construction, containing but one moving element, running with a clearance in the casing. They are simple to install and operate, they require little floor space and are noiseless in operation. Their use results in a marked economy in coal. Many users hold that they more than pay for themselves in this respect alone. A Jennings pump on your system means quick heat in the most isolated radiators at a minimum steam pressure.

Now is the time to consider equipment for replacements and new installations for this season. Our Engineering Department is at all times ready to render service on problems relating to heating.

NASH ENGINEERING CO.

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Industry Illustrated

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Adolf Schildkraut
Art Director

EDITORIAL

Men and Materials

IN connection with the determination of the strength of materials for construction work, it is of primary importance that an engineer should know what is the elastic limit of each kind of material he uses. The elastic limit is "that load at which the deformations begin to increase at a higher rate than the applied stresses." In other words, it is the point at which a load becomes too great for a material to bear safely.

This elastic limit is different for each different kind of material. Some materials have extremely high elastic limits, such as steel; others have comparatively low elastic limits, such as wood. Two specimens of steel, or of wood, that appear to be identical, may show radically different values for elastic limit between the two steel specimens or between the two wood specimens, due to invisible differences in their molecular structure. It is evident then that the elastic limit for materials is a variable limit.

What would be the opinion of his brother engineers if an engineer disregarded the difference between the elastic limits of steel and of wood and used these materials interchangeably in building a structure; making one column, or brace, or girder, of steel and making the next, that is intended to carry the same load, of wood? The very least they would say of him would be that he is no engineer and, without doubt, their private opinion would be that he had become crazy. They would know that no material structure built in such a manner could fulfill the purpose for which it was intended.

How strange it is, therefore, that so little attention is paid in industrial affairs to the elastic limit in its *human* application and that so few attempts are made to differentiate between men who have low elastic limits and those who have high elastic limits.

There is a great difference, however, between materials and men. The materials having high elastic limits are most valuable for constructive purposes, but those men who have *low* elastic limits are the most valuable to industry. A high-strung, sensitive, temperamental man, possessing a high degree of mentality or intelligence, has a very low elastic limit; but a phlegmatic, stolid man, possessing a comparatively low degree of mentality but much greater physical strength, has a very high elastic limit. The former can only withstand carefully considered loads carefully applied; the latter can withstand heavier loads less considerately applied.

Why, then, does industry so often load each of these equally with the same kind of work and expect as much of one as of the other, applying the same value for elastic limit to both? Each type has his place and each of them is a good workman, but men—no less than materials—must be differentiated on the basis of the value of their respective elastic limits. Only so, can Industry progress.

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Planning the New Factory Building

By Walter F. Ballinger

President, The Ballinger Company, Architects and Engineers

SOME factories just grow, and grow so fast that many inefficiencies in layout and operation creep in, which, though recognized and regretted, are allowed to continue because their correction would take time and effort that could be more profitably expended elsewhere.

When a plant is making money, and is growing so rapidly as to absorb all of the executive's time and spare capital trying to keep up with a profitable and increasing demand, who would say it were better to stop, reorganize, and reconstruct, in order to conform to accepted standards of efficiency? Efficiency experts must increase profits, not retard them.

But when circumstances require the relocation, rearrangement, or consolidation of existing plants, and when new plants are organized no one will question the value of thoroughly planning the new unit to incorporate every possible means of increased productive capacity and decreasing production costs.

Planning the new factory to attain the owner's Utopian dream of maximum production at minimum cost is not a complex process in itself, but it requires an analysis of many complex factors, and a nice judgment in balancing the advantages and disadvantages of each element entering into the problem. Many schemes are offered that will increase production enormously, at the same time increasing manufacturing costs. Many means will suggest themselves for cutting down the cost of the plant at the expense of productive capacity. The real job is to select those arrangements, materials, and methods that function to increase production without increasing the cost, or to decrease the cost without sacrificing output.

The first step is to gather facts. It is facts, not guesses or deep-rooted opinions we need. Many plants are laid out incorrectly because the owners have assumed a knowledge of facts when they have simply held opinions. Facts are hard to gather, especially if the collector be thoroughly familiar with existing conditions. An outsider can see many important facts that the owner sees, but does not duly appreciate. Have you ever

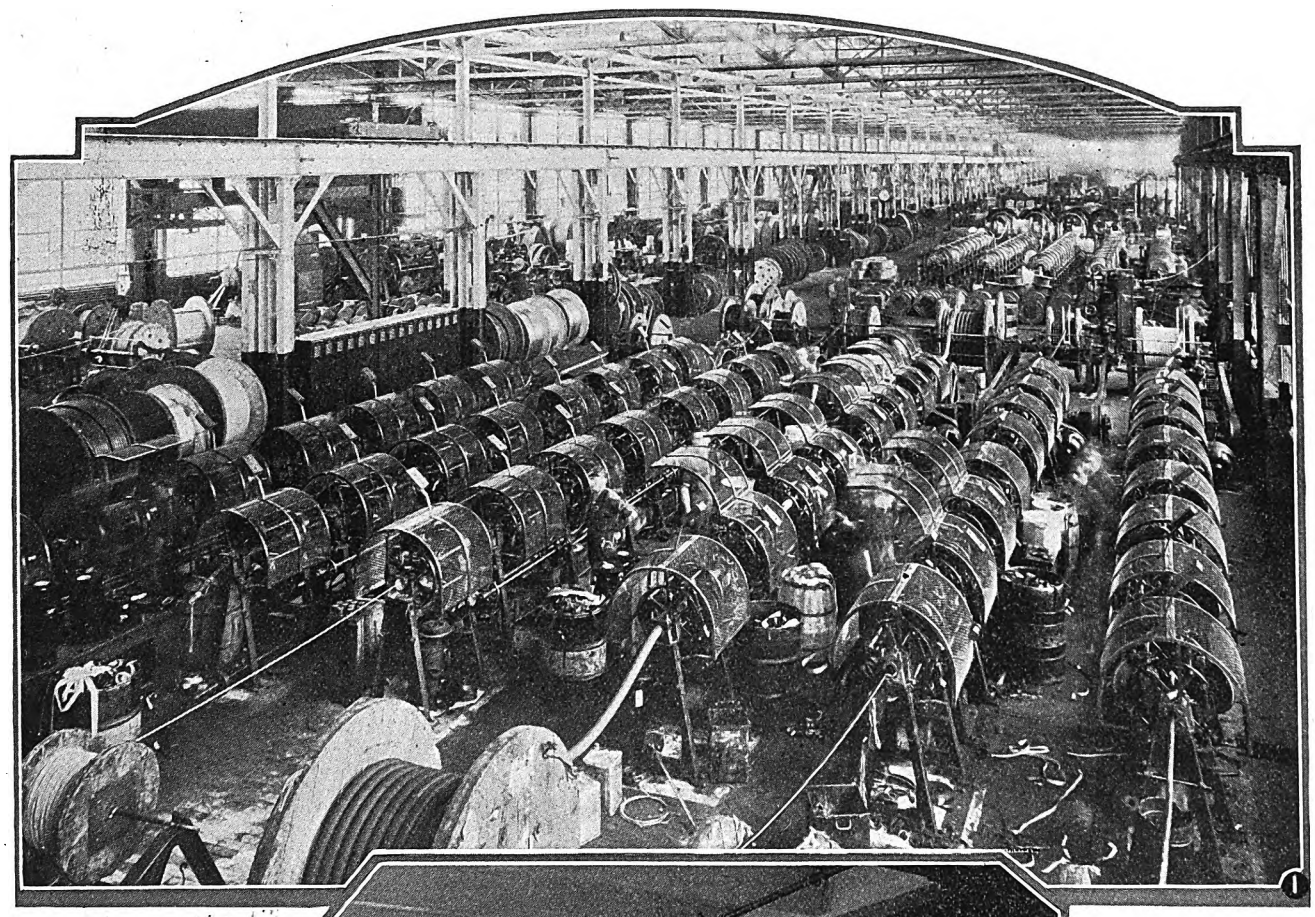


Fig. 1. Space requirements and building types are affected by the nature of the process. Automatic machinery, for example, secures high production per unit of floor space.

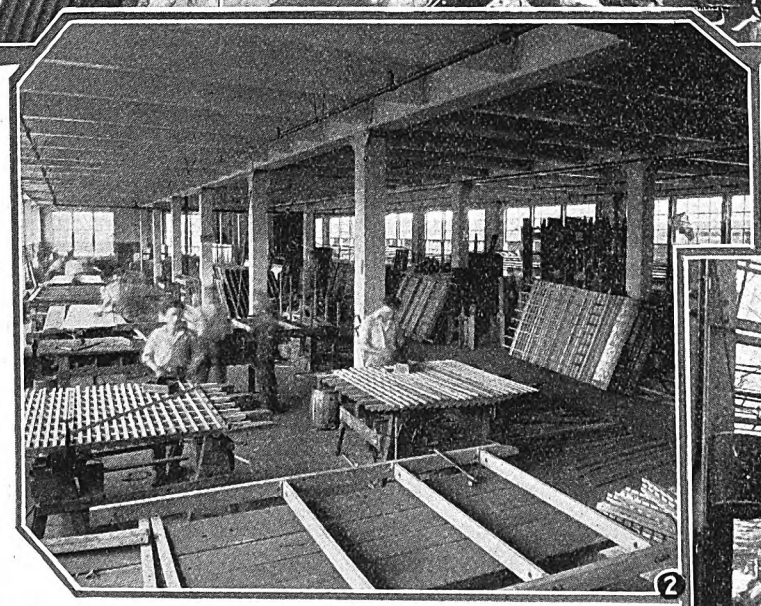


Fig. 2. Where hand work is required and particularly on products such as the above, production per unit of floor space is necessarily low and suitable physical arrangements must be provided.

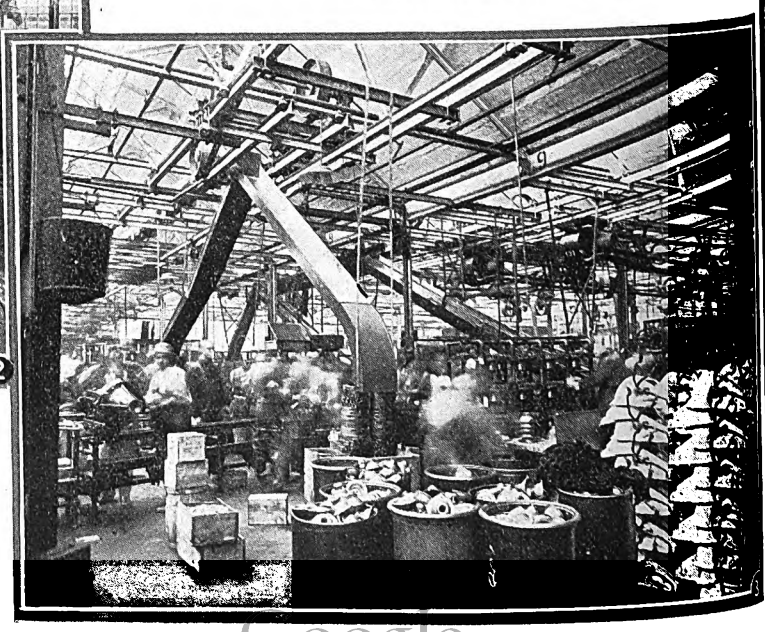


Fig. 3. Work must be brought to and taken away from machines. An estimate is required of the space necessary for aisles, trucks, cans, baskets and other containers.

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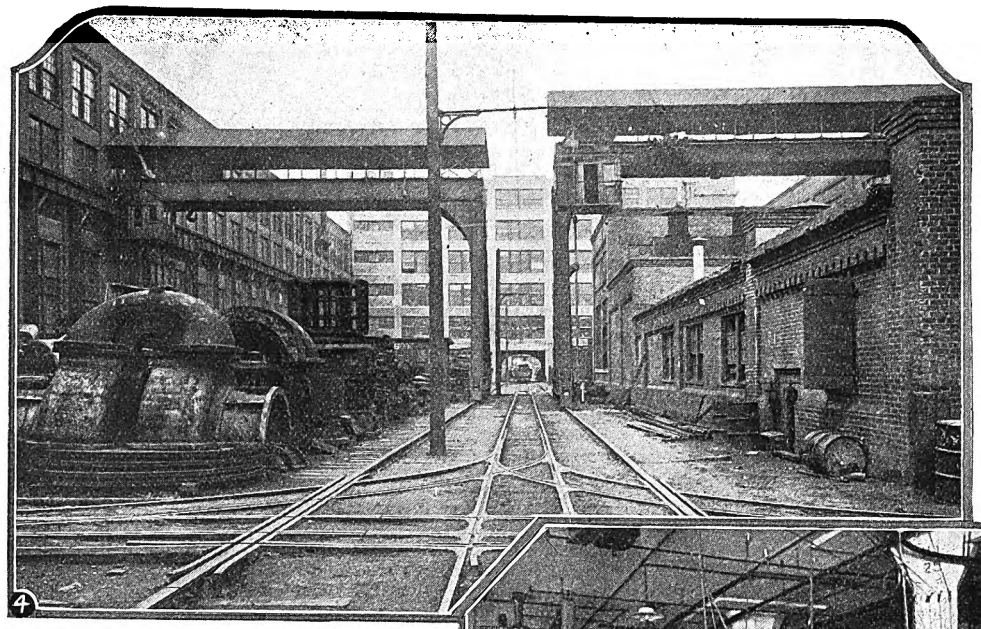


Fig. 4. Storage of materials in all stages of completion must be carefully studied and provided for either outside or inside of the building.

taken a sight-seeing bus in your own town, and realized how many things, commonplace to you, are pointed out to visitors as places of special importance and interest? The principle is the same.

To gather facts, we should work from the general to the particular. An analysis of the market for the product should be made, showing the present demand and the probable future demand for your goods. Then you should establish what proportion of the total demand you intend to supply, both in the immediate future, and, if possible, a decade or so hence. This will give you a basis for estimating your production capacity, and will indicate the probable rate of plant expansion to be provided for. Admittedly, this first step calls for rare judgment and business foresight, but it is of fundamental importance.

Having established your output (per day, week, or month), the product itself is analyzed into its component parts. If your product is lead pencils, there are the two halves of the wood-shaft, the graphite core, the metal ferule, and the rubber tip. The quantities needed of each different part being established, the machines required to produce each part are considered. Some parts will be produced by automatic machinery



Fig. 5. While the contributing departments may be independent, the product parts must come together for assembly. This must be considered in the original plant layout.

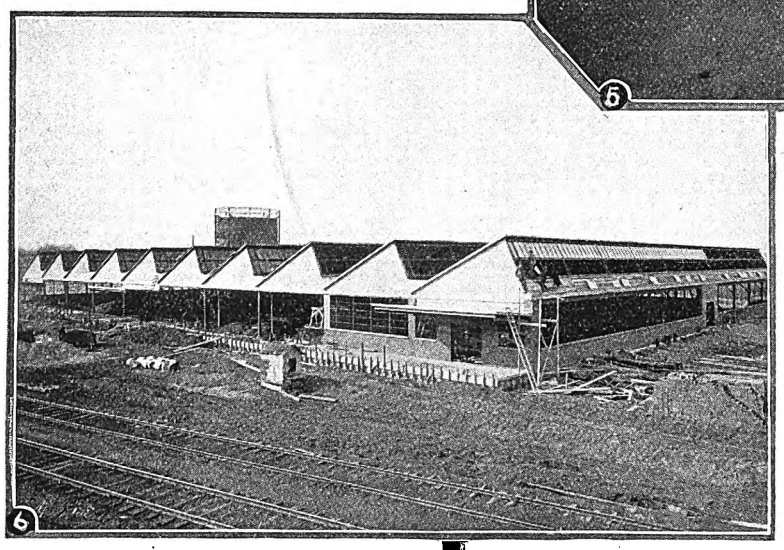


Fig. 6. Where land values are low the choice of a one-story as compared with a multi-story building must be made with care.

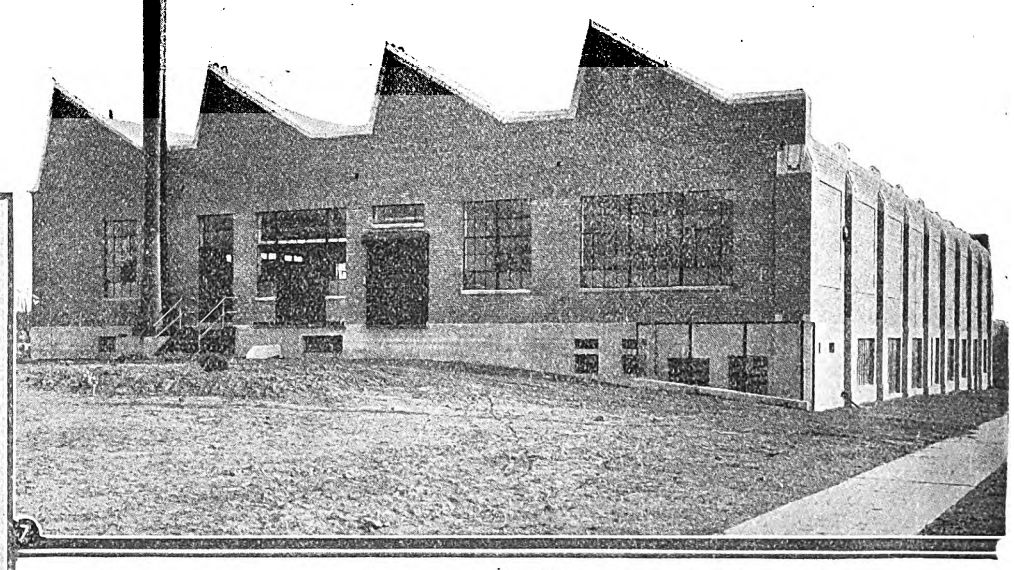


Fig. 7. The one-story building requires more roof and foundation wall but under some circumstances may actually cost less per productive square foot of floor space.

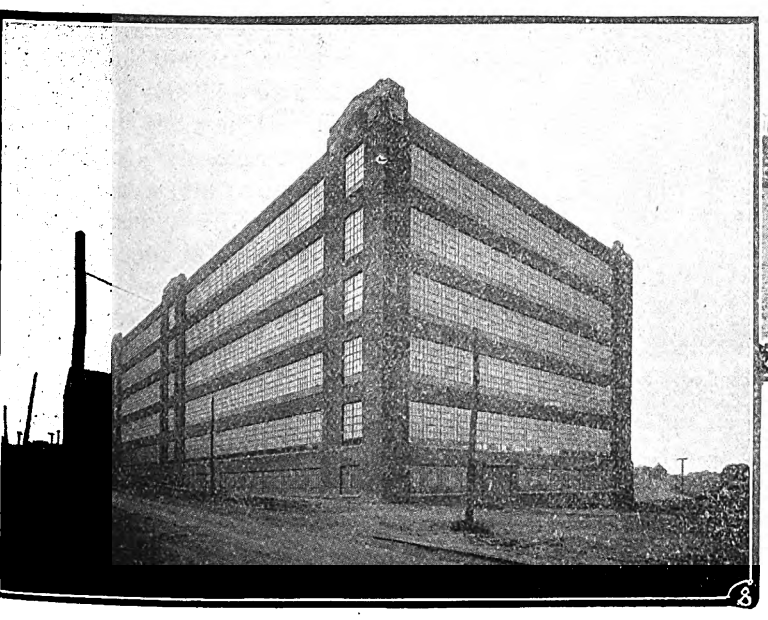


Fig. 8. Land value is not the only consideration in the choice of a multi-story building. The nature of the process may dictate this type of construction.

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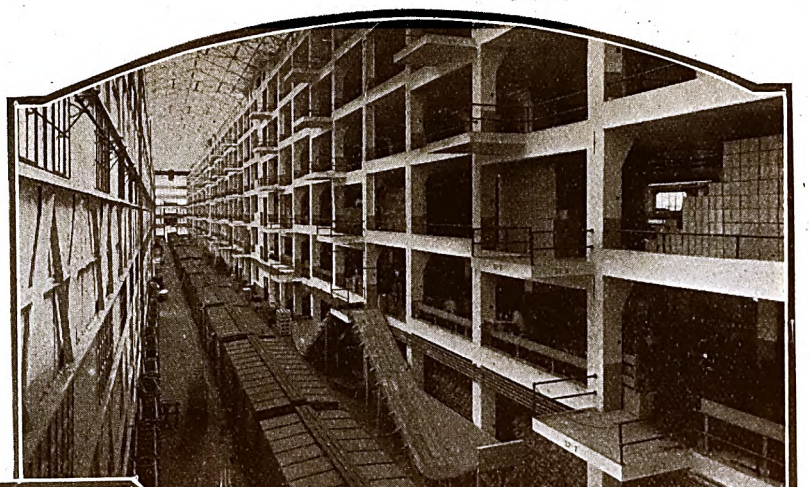


Fig. 9. The various floors of a multi-story building may be compactly knit together for transportation and shipping purposes through modern design and construction.



Fig. 10. The modern industrial plant can be erected with amazing rapidity once its plans have been determined. But careful planning in advance is essential to highest output.

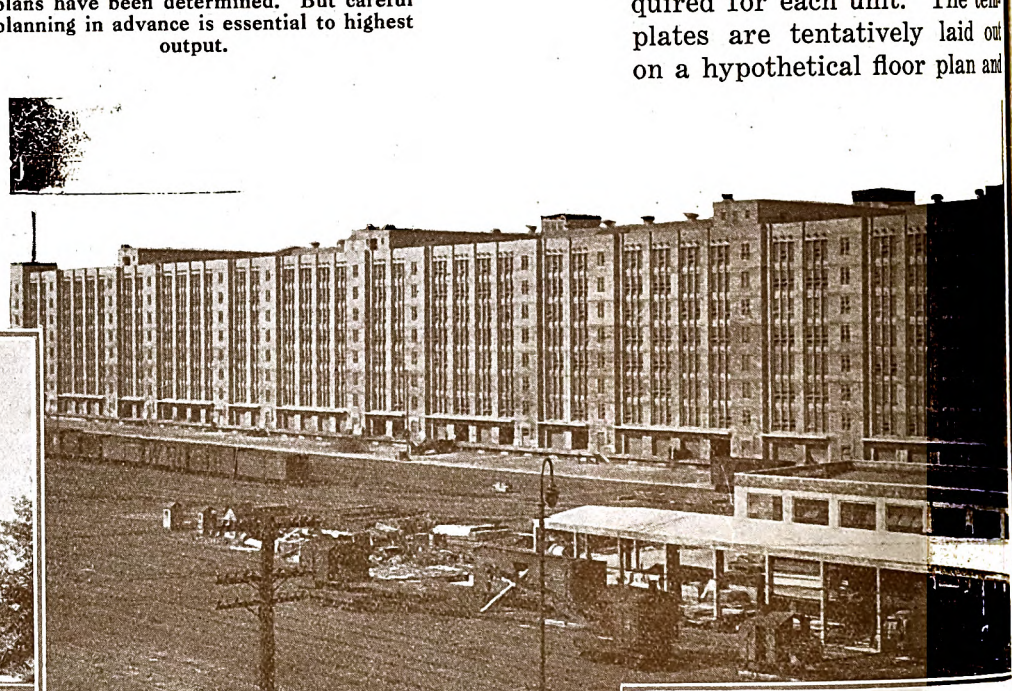


Fig. 11. The choice of structural materials for the building should be determined after all the other factors are known. Concrete,

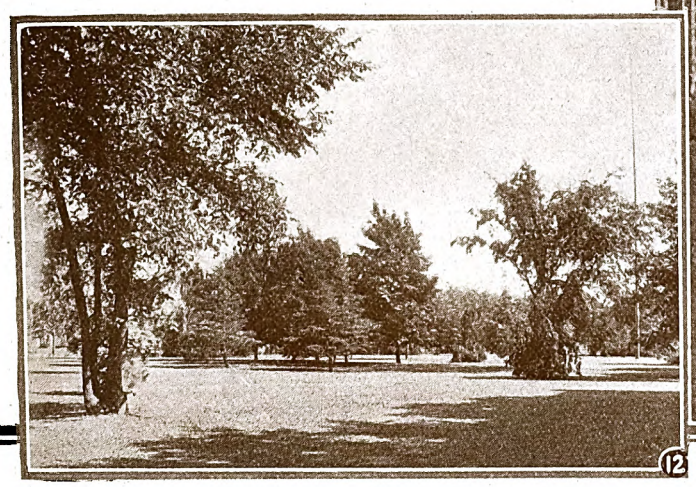


Fig. 12. Planning the grounds for beauty and convenience is an integral part of modern plant layout and has its distinct effect upon production.

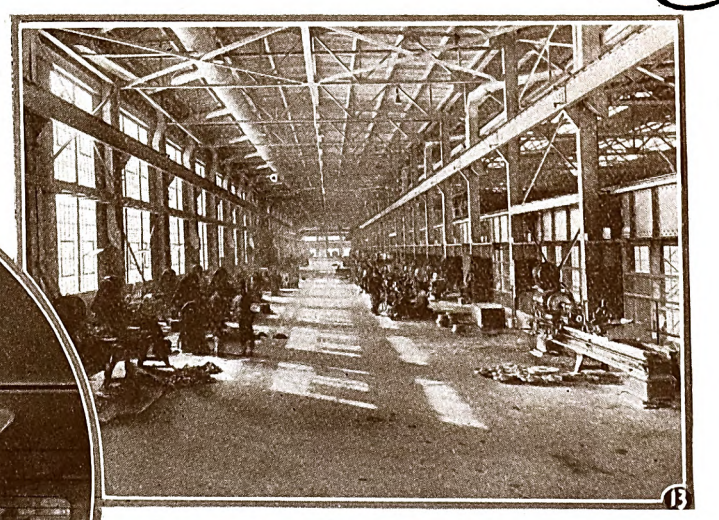


Fig. 13. Unprotected steel framing may be safely used in some structures but in others would entail a great loss in the event of fire.

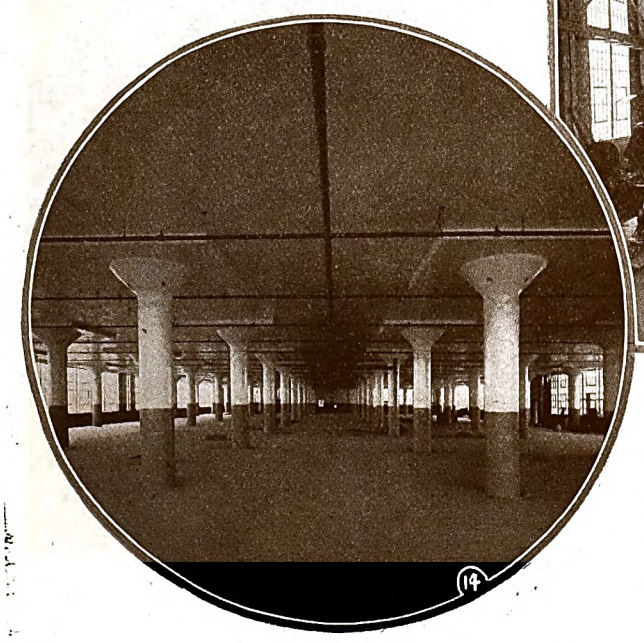


Fig. 14. Columns are planned in such manner as to interfere least with the machines on all floors, also to provide flexibility as far as possible in future and different uses of the building.

at high speed, and very few machine units will be needed. Other parts will require processing through many different machines and possibly will require hand-work of many operatives. A complete schedule should be made showing the number of each kind of machine necessary to produce the parts, which, when assembled, will comprise the required output of your finished product. If your product is diversified, the same analysis must be made for each article.

All this sounds elementary, perhaps, but often it is well to check over each step in a development, to make sure that no points are overlooked.

With the schedule of machines in hand, templates are cut out of cardboard to some convenient scale, showing the floor space required for each unit. The templates are tentatively laid out on a hypothetical floor plan and are spaced to allow room for the operatives, and for the materials (both unfinished and finished) that are associated with each machine. A decision should be reached regarding the need for space to repair and adjust each machine. The older method was to allow ample room for working around each unit; in many modern plants no extra space is allowed for such purposes, the machine being removed bodily for repairs, or else the repair work is done when the plant is closed at night or on week-ends.

While this arranging process is going on, many other factors must be taken into consideration. Work must be brought to and taken away from the machines, requiring aisles and space for trucks, cans, baskets,

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and other containers and handling equipment. To arrive at the space needed for each of these items, an estimate must be made of the amount of material in each space at any time, and the bulk it occupies.

Let us go back to our production schedule. After analyzing it to develop the number of machines required for each part, we should also arrive at the amount of raw material needed to meet the established output. This subject should be pursued until we have found out the quantities, weights, and volume of each kind of raw stock needed to be kept on hand at any given time. Sometimes this means going far outside of your own plant to determine what deliveries you can rely upon from sources beyond your control.

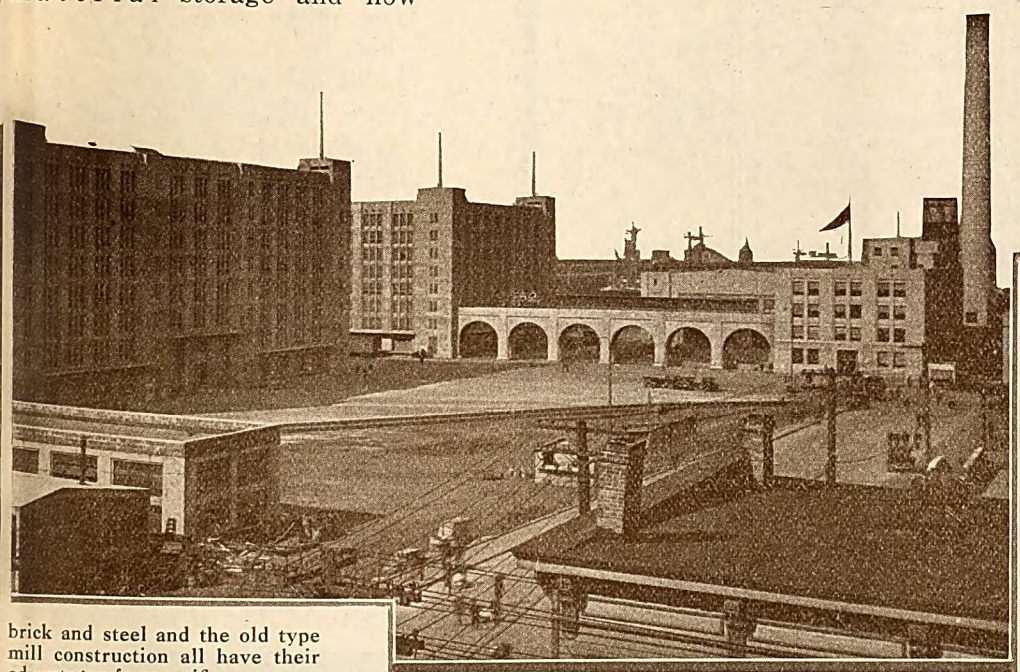
With these data at hand, we should set about establishing a material storage and flow



Fig. 15. Proper space must be allowed for conveying equipment, work in process, and for the operators in arranging for column spacing and location.



Fig. 16. Toilet and wash rooms, like stair towers, elevators and fire escapes, must be located in positions which best meet requirements.



brick and steel and the old type mill construction all have their advantages for specific purposes.

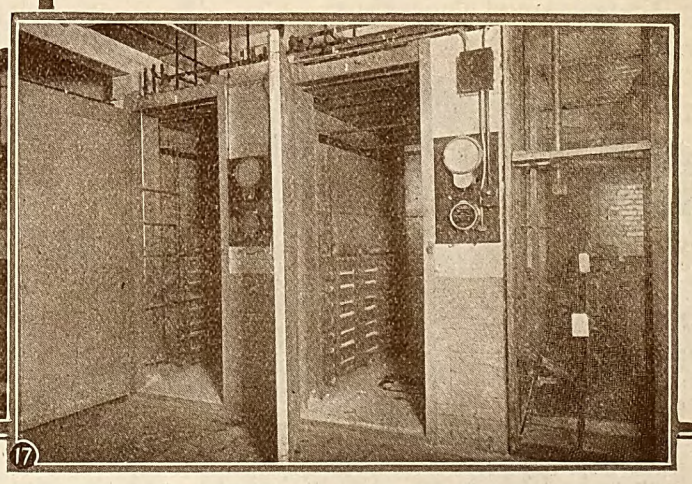


Fig. 17. Electrical feeders and the distribution system govern the location of switchboards, conduits and distributing panels, and must be carefully planned in advance.

scheme covering not only the space required to take care of the stock at each stage in the process of manufacture, but also the method of handling it from the store rooms, through the plant to the shipping platform.

We now have in hand the principal space requirements for our building, for we know the space needed for the machines and their operatives, for material in storage and in process, and for traffic through the plant both in vehicles and in conveyors.

This work will already have suggested certain desirable relationships between machines and processes. We will find lines of demarcation between certain parts of the work where the rela-

(*Continued on page* 71)

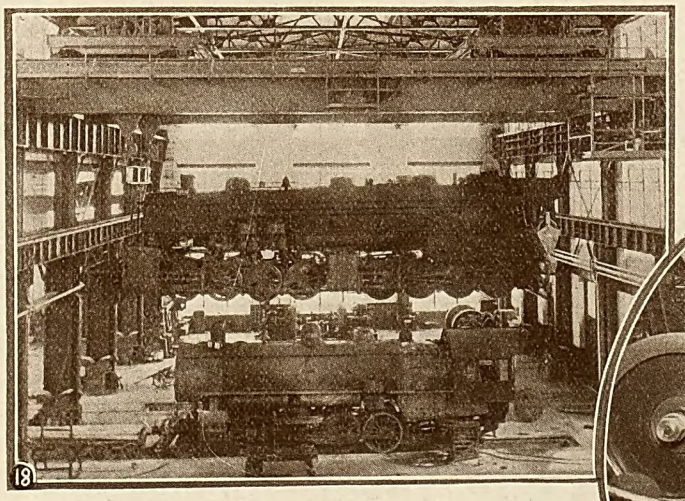


Fig. 18. Overhead travelling cranes have a decided bearing upon the type and size of structural steel work required for their support, in addition to ordinary structural requirements.

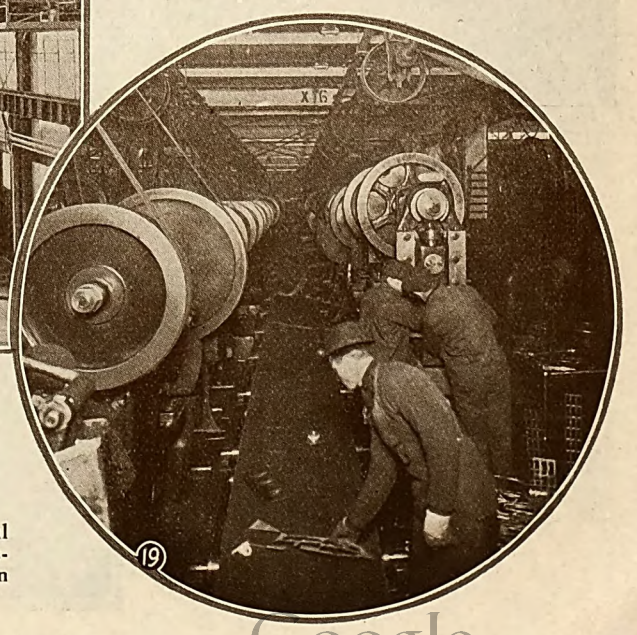


Fig. 19. The modern system of mechanical handling has revolutionized machine placing and spacing, and is a prime factor in building planning and layout.

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Health, Production, and the Plant Plumber

By William G. Ziegler

THE work of the Pipefitters, Plumbers and Tinsmiths has a very important influence on the health of all the workers in the plant from the manager down to the least important worker, for if the plant is improperly heated and ventilated and has unsanitary plumbing, the chances are that many men will be home sick for days at a time when they should be producing. This is an economic loss which will not be continued long if one would investigate how much this neglect is costing every year. If the plant is underheated, the men will waste one or two hours in the morning making themselves warm, and even if they are doing piece work, they are not getting out the capacity of the machine on which they are working. Machines and floor space cost money whether they are being utilized to capacity or not. Improperly ventilated rooms are also hindrances in the performance of the work, making the workers "logy" or sleepy and thereby preventing their doing the best in them. Probably the most insidious cause of disease is unsanitary plumbing and it should not be tolerated. Up-to-date plumbing fixtures properly installed are a paying investment, and if they are kept clean, all danger from this source will be eliminated.

In the maintenance work on piping in old plants or in plants where changes or additions have been made from time to time, it will often be found that the piping is not properly laid out, but goes in a roundabout course. In this case, it is well to rip it out and straighten the runs, if economical results are to be expected. In this article we will consider only the maintenance of the piping in the plant proper, that is, all piping outside of the power plant. A great deal of damage is done each year by leaks in piping and fittings and this loss can be largely obviated by proper maintenance.

Overheating is not to be recommended, because it is not good for the men. The correct temperature for any class of work should be carefully studied and that temperature should be maintained. It has been found, from years of experience, that a temperature of 68° F. is correct for work-rooms, such as assembling rooms and machine shops where the men do only a small amount of heavy manual labor. However, in foundries or other places where hard or heavy labor is performed, the temperature should be between 55° F. and 68° F. depending on the work.

In connection with overheating, it has been found that in light assembling rooms where the normal temperature should be 68° F. that an increase to 75° F. caused a loss in production of fifteen per cent. At normal working temperatures the degree of humidity should be between fifty to seventy per cent.

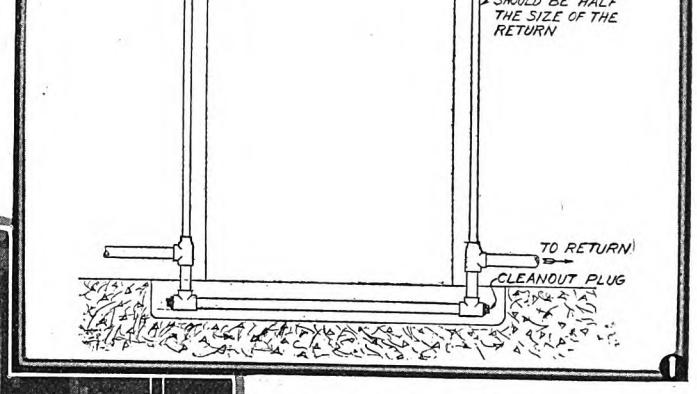


Fig. 1. Where it is necessary to run a heating pipe return line under the floor at a doorway, the sketch shows a method which has been found most practical.

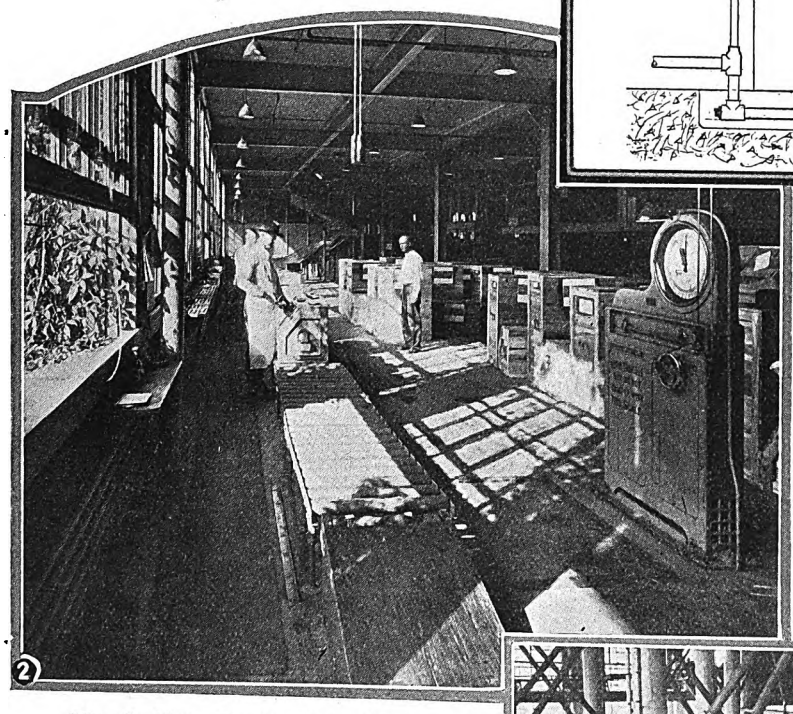


Fig. 2. Note the location of heating pipes below the windows. These pipes should be so supported as to allow for expansion.



Fig. 3. In buildings with high ceilings, the purity of the air is not much affected by recirculating it; which simplifies the heating problem materially.

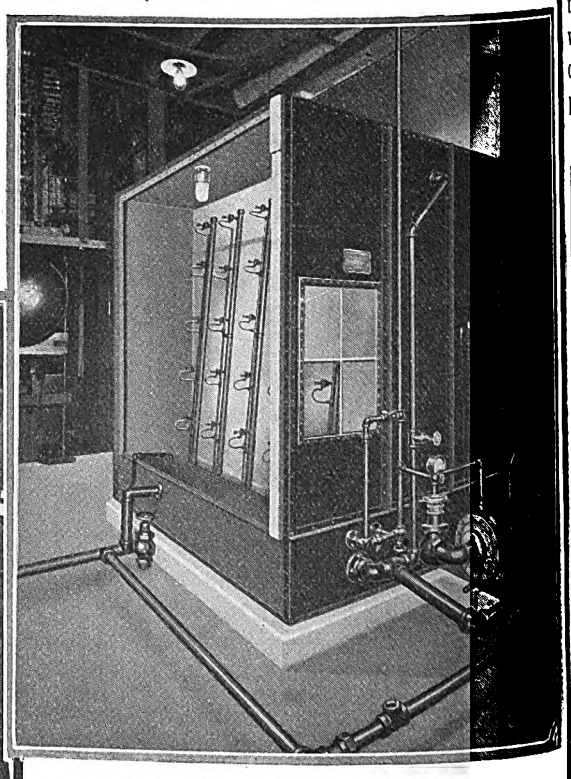


Fig. 4. Air washers are finding an ever wider application in industry, and the health of both men and delicate machines depends upon their proper functioning.

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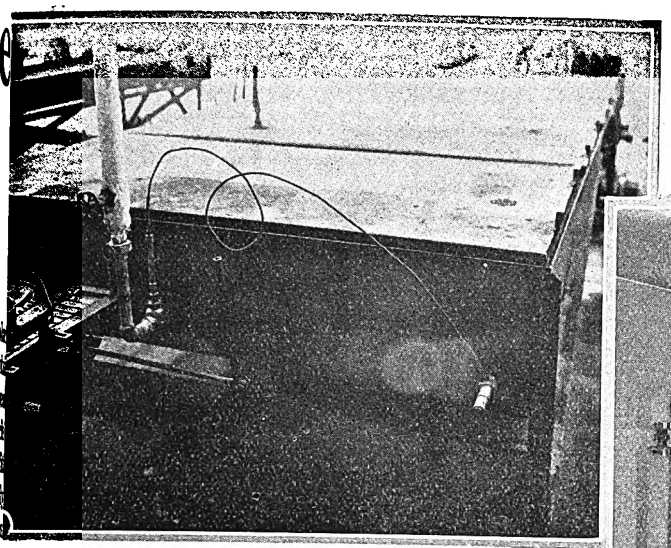


Fig. 5. Temperature regulators, for controlling temperatures in process tanks, ovens, etc., are a source of saving in heat that must not be overlooked.

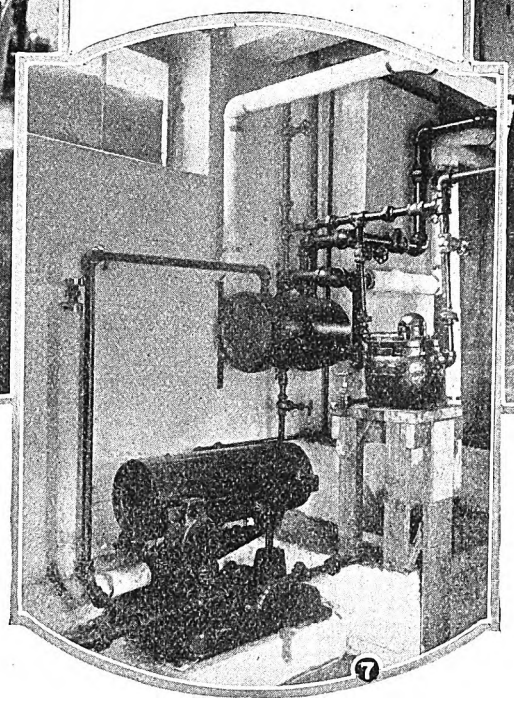


Fig. 7. A great deal of steam is wasted by failure to use the proper kind of steam trap—and, in some cases, failure to use any trap at all.

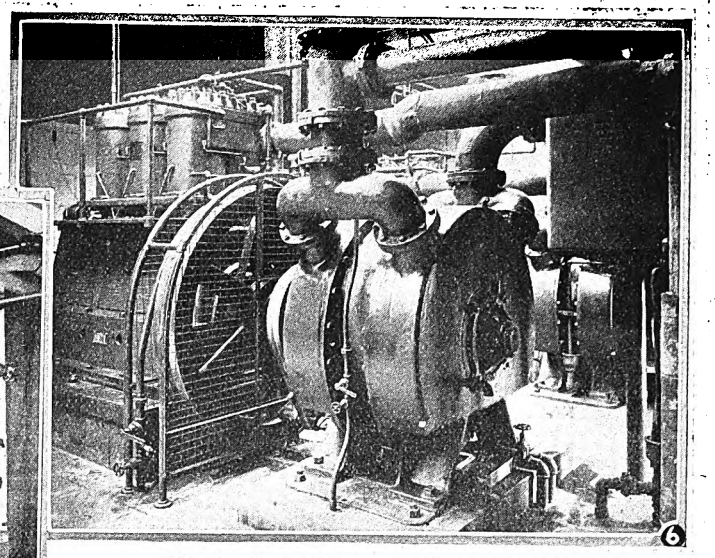


Fig. 6. The packings on valves and flange gaskets have a habit of drying up. Such packings should be renewed before they have a chance to allow leakage.

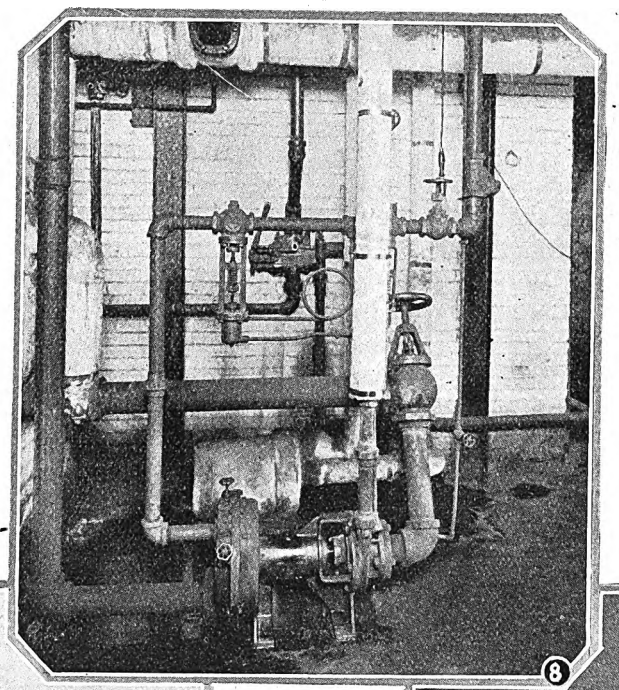
his is a very important point o be considered in connection ith heating, as in nine cases out f ten, the air in industrial lants is too dry during the win- er season. This subject will be onsidered more in detail later n this article.

Most industrial plants are eated by so-called direct radia- ion, that is steam or hot water adiators or pipe coils. There re three systems commonly sed: (1) The two-pipe system or steam heating, having an pen or gravity return line; (2) he vacuum system of steam eating, and (3) The hot water eating system. In the first nentioned open or gravity re- urn line system, the pressure in he piping and radiators is a lit- le above atmospheric pressure. he condensation flows by grav- ty to a tank or sump, which is ented, and from there returned o the boiler. During mild eather the boiler pressure need nly be a little above atmos- heric pressure and in very cold weather the pressure may be raised up to about ten pounds at which point the safety valve will blow off.

In the second mentioned, or vacuum system of steam heating, the pressure in the supply piping and radiators is maintained either at atmospheric pressure or slightly above or below it and the pressure in the return piping is maintained at less than atmospheric pressure by the vacuum apparatus. These two systems are similar, the difference being the method of taking care of condensation and air along with it.

In the third or hot water heating system as used in plants of any size, the water is heated in a closed heater and circulated by means of a pump. As this system requires more radiation surface than either of the steam systems, it is not largely used in plants. Another point to be considered is that it requires a large closed heater and a pump, usually a turbine driven centrifugal.

Fig. 8. From the standpoint of economical maintenance, the savings which can be effected by the judicious use of pipe covering, are everywhere apparent.



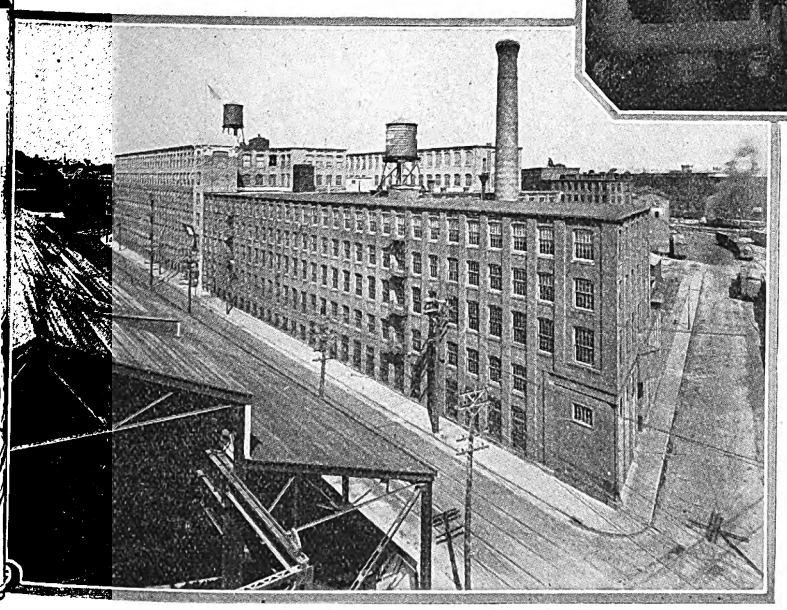


Fig. 9. Sprinkler protection pre-supposes tanks—and here provision must be made to guard against leakage and against the possibility of freezing.

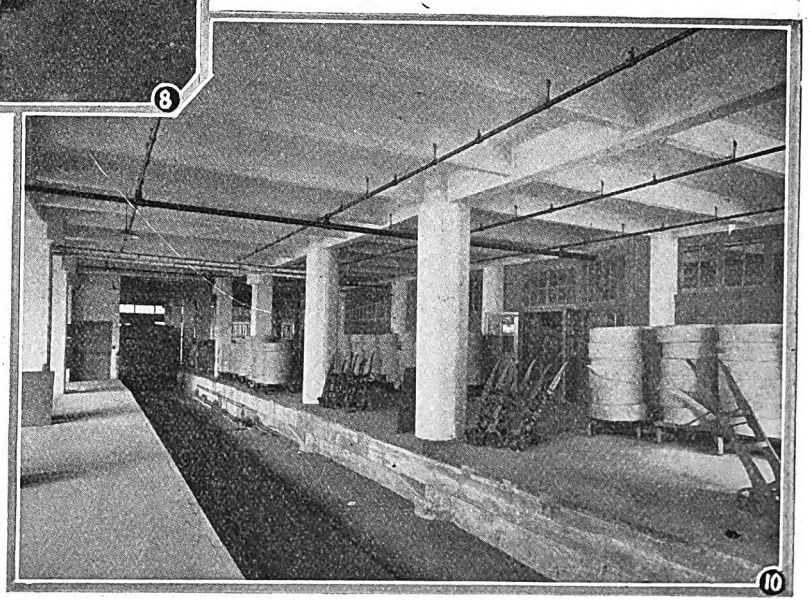


Fig. 10. In exposed or unheated places, requiring sprinkler protection, the "dry pipe system" is the obvious solution; doing away with the possibility of frozen pipes.

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Fig. 11. Valves on sprinkler lines should be sealed, and it is a good plan to have enamelled signs at each valve, listing the rooms it controls.

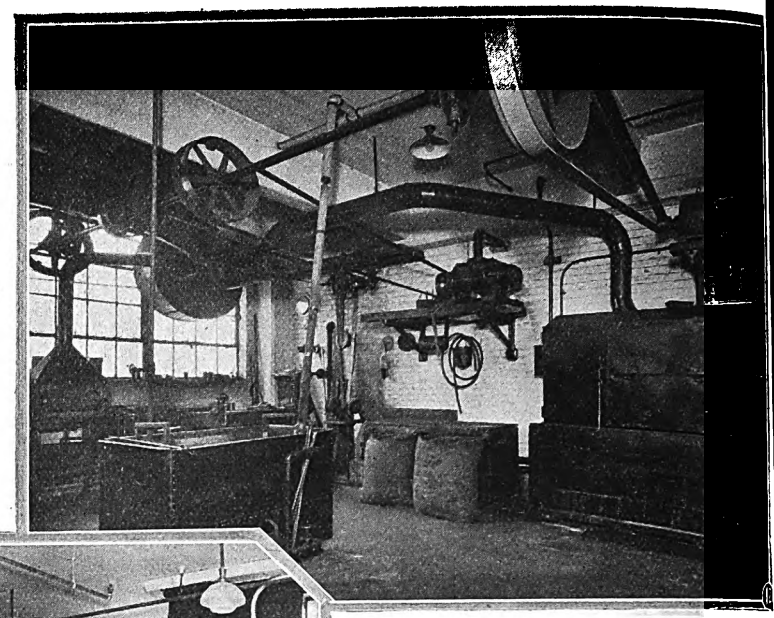


Fig. 12. Steam for process work, tanks, etc., should be on separate lines from the heating system, so that only these separate lines need be open in summer.

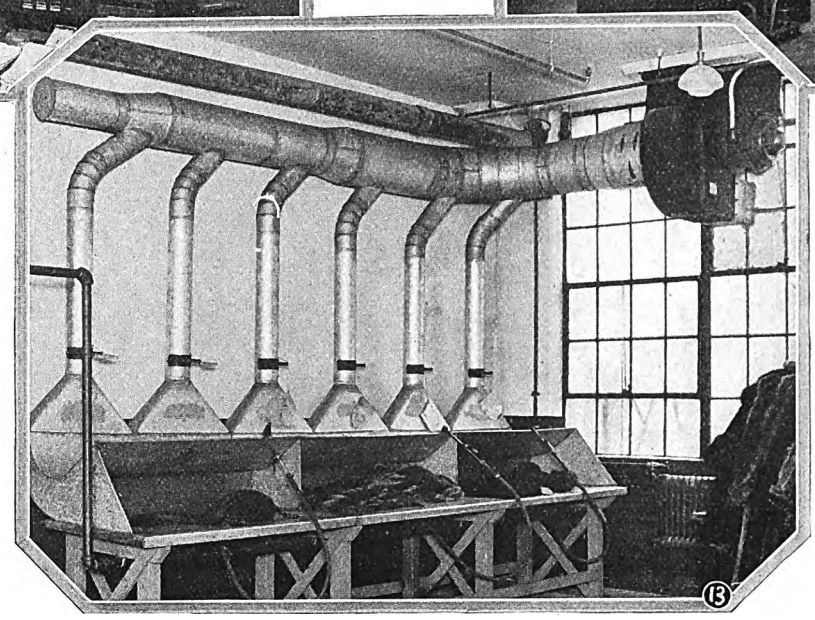


Fig. 13. The same idea which has been applied to drawing out poisonous fumes and dust is used to an increasing extent for carrying away dirt and keeping the air free from contamination.

The whole subject of heating is one which can be scientifically treated, the structural details such as window areas playing as important a part in the correct design of a heating system as the cubic contents of the building. With coal prices at their present level and with wages about double what they were ten years ago, any losses that can be cut down due to poorly designed piping, should be carefully investigated. In order to meet competition all costly wastes that have been allowed to go on, must be stopped and every unit made to function at a minimum cost.

In order to take care of expansion in steam pipes, bends should be used, or else expansion joints should be installed. Where there is space for them, bends are preferred as there is nothing to get out of order if the bends are properly designed. In cramped quarters, expansion joints are used, but they should be provided with an anchor base, so that they can be securely fastened. In the average plant, pipe coils are used for radiation. In order to provide for expansion and contraction, a mitre piece should be put on the end nearest the supply. This mitre should be about one-tenth of the length of the coil itself. Coils should not be longer than sixty feet in order to obtain the best results. They should be anchored at the return header, so that the expansion will be at the mitre at the other end.

The question of correct design and size of distributing pipes has a great deal to do with the even distribution of heat throughout the plant. If pipe sizes are not correct on the branches from the mains, the coils nearest the boiler will receive all the heat. It is possible to throttle valves or put in smaller pipes leading from the mains to the coils nearest the boiler, but in old systems which are not efficient, it is best to call in a heating engineer who will guarantee to make the system function properly. One system now on the market makes use of orifices inserted into each feeder where it leaves the main. However, all the well-equipped heating engineers strive to accomplish the same result, namely, even distribution of heat at a lower cost.

In buildings with high ceilings, such as erecting shops, foundries, etc., the unit system

(*Continued on page* 61)

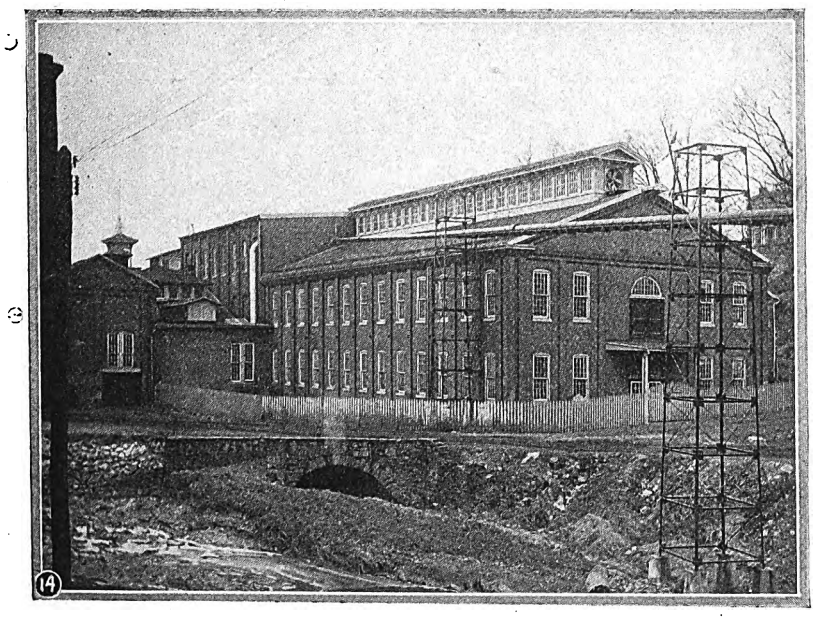


Fig. 14. In this plant, not only is ventilation accomplished by forced draught, but in the foreground is a pipe used for conveying cotton to the mill by means of moving air. Obviously, the maintenance department must function properly here!

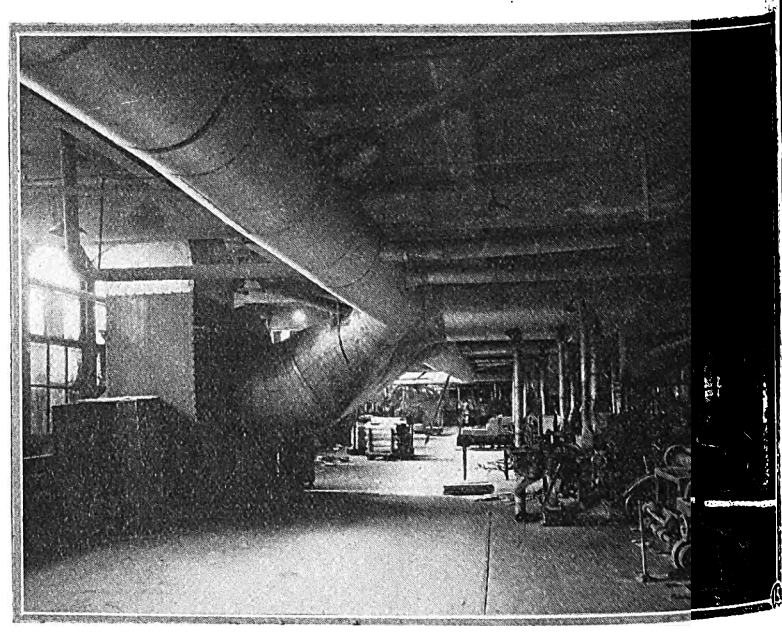


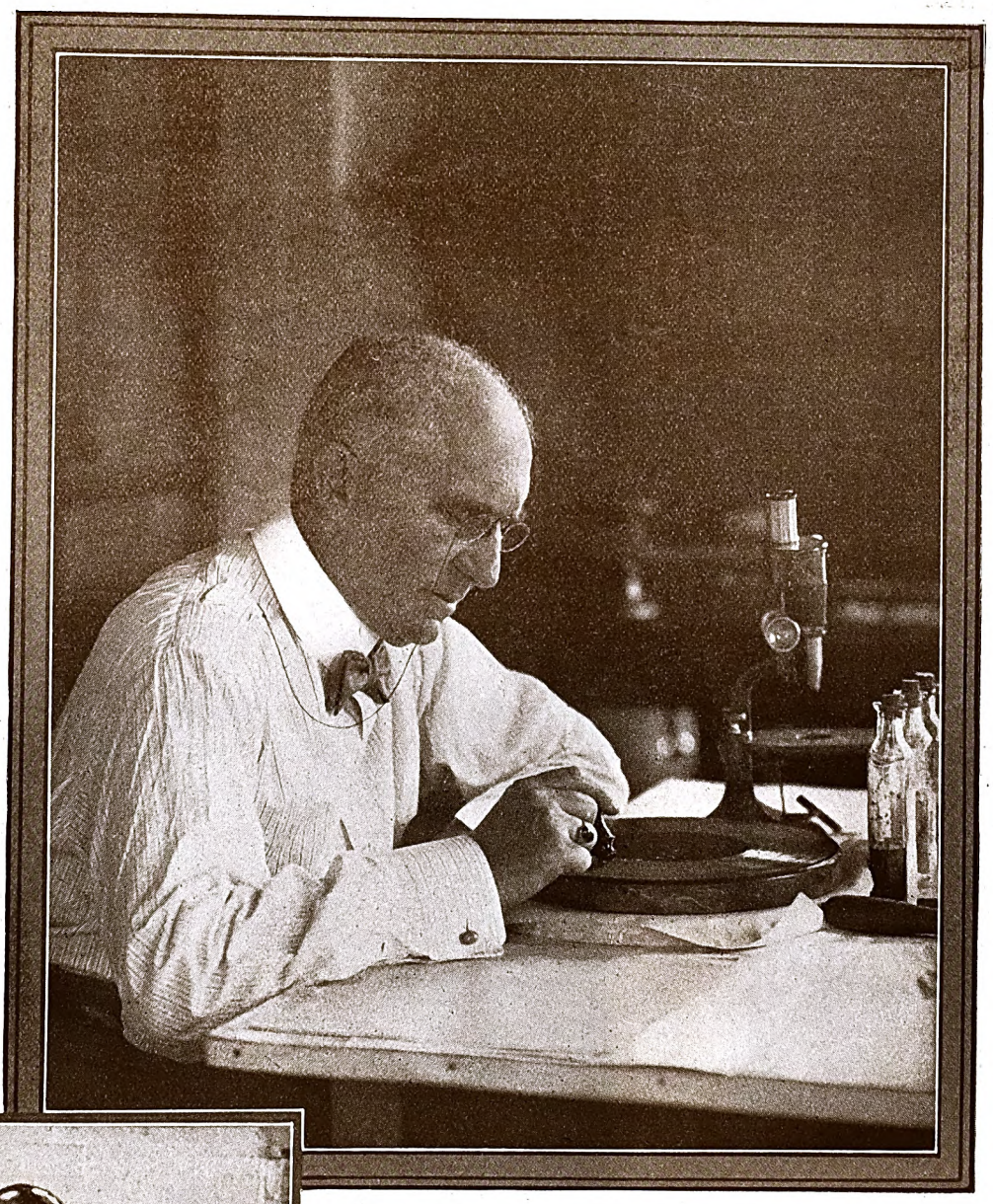
Fig. 15. The exhaust system of a woodworking department must be kept in proper shape. Not only is its work exacting, but, in most states, such installations are required by law and are held to rigid regulations.

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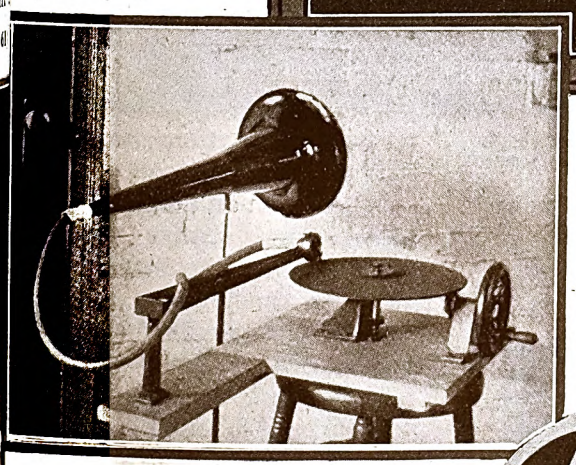
Freeing the Human Voice From Its Inherent Limitations

Emile Berliner, Inventor of the Telephone Transmitter, which Projects the Human Voice Indefinitely; and of the Gramophone, which Immortalizes It

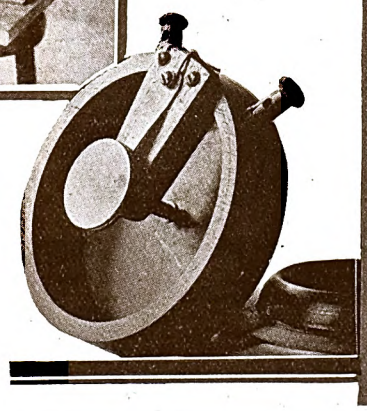
By Ernest H. Rowe



Emile Berliner. Hardly man, woman or child in the civilized world but owes pleasure, convenience, health or safety in some measure to this server of mankind, through the instrumentality of the telephone transmitter, the disc talking machine, or the now almost universal understanding of the dangers of raw milk and of simple hygienic habits.



At the left—The gramophone as the Franklin Institute first saw it in 1888, employing two new and distinct ideas in sound reproduction—the disc record and the swinging arm to carry the reproducing stylus so it may follow the spiral record groove, being both vibrated and propelled thereby.



At the right—The telephone transmitter when, through Berliner's discovery of the loose contact principle, and his use of the induction coil, it first became a simple appliance capable of general use and easy to manufacture. Photographed from the exhibit in the National Museum, Washington.



The Berliner gyrocopter in a short experimental flight, "skimming the daisies."

THERE are some pictures to go with this story, but you can illustrate it better yourself. The objects themselves, better than mere pictures, are probably in sight as you read this if you are in your living room or library. To get the right atmosphere, before you settle down to reading in your morris chair, set your telephone on one side and start the Victrola going with "Yankee Doodle" or the Declaration of Independence for just the right local color. Then set up before you the picture on this page, the portrait of the man who is responsible for the telephone transmitter and the disc talking machine, Emile Berliner, of Washington, D. C. One thing more—go to the ice box and bring out a bottle of pasteurized milk. It is a vital detail of our scenery. If you can add a healthy, hungry baby pulling on the bottle, all the better.

What has a telephone transmitter or a gramophone to do with bottle babies? Nothing. But Emile Berliner has had much to do with all three, besides other things without which our twentieth century civilization would not differ so much from previous centuries as it does. I sometimes stand on the Battery sea-wall when the ferry comes over from Ellis Island and I see other spectators grin and hear them sneer or joke about the "wops" or "heines" or "squareheads" as

(*Continued on page* 50)

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Mechanical Handling

Loaders and Unloaders that

By Matthew

EVERY year, especially during the winter months, the press of the country proclaims a car shortage. This car shortage is not limited to any one period, but is restricted to seasonal conditions, i. e., in the summer time there is a shortage of cars for the shipment of fruit to large municipal centers; in the fall there is a shortage of cars for shipping grain from the farms to the grain elevators and mills; also at the same time of the year there is a shortage of cars for the transportation of coal. In most cases, the public is inclined to place the entire blame for these car shortages upon the railroads. It is true that they are largely responsible, but the shipper and receiver are also partially at fault, the reason being that they do not unload cars immediately upon receipt at the various destinations, and when they do load or unload them, the more modern and efficient methods are not always employed. Only recently the writer saw a gang of men shovelling coal from under gondola cars, and wheeling it to the storage piles, taking days to unload a few cars which could have been unloaded in a very few hours.

If a simple belt conveyor like that shown in figure 1 had been installed, the result would not only have been the immediate release of much needed coal cars, but the small plant executive could have used the common labor more advantageously elsewhere about the plant, and substantially reduced his handling costs.

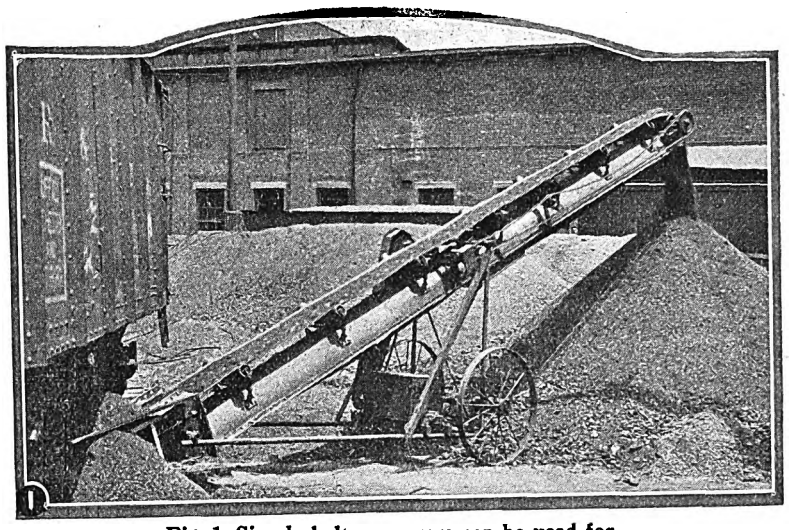


Fig. 1. Simple belt conveyors can be used for unloading fine materials direct from car to storage pile.

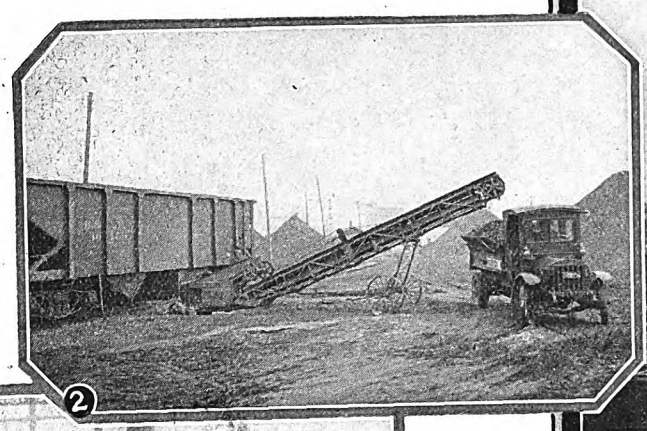


Fig. 2. Belt conveyors in combination with special unloading conveyors handle large material direct from cars to trucks or pile.

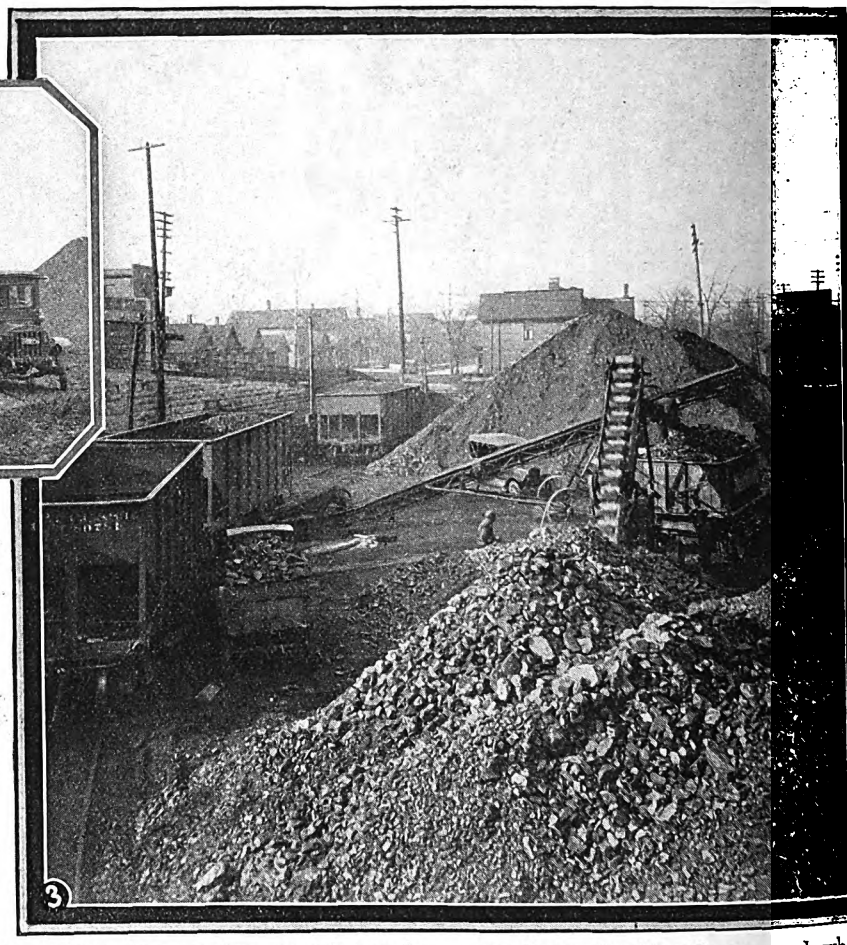
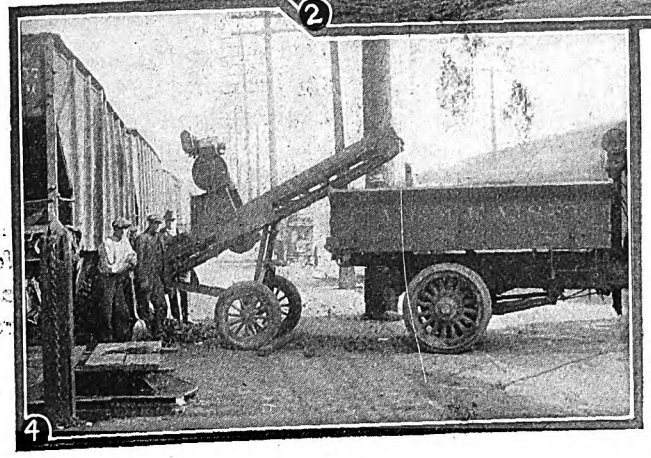


Fig. 4. A portable belt conveyor equipped with gasoline engine and large automobile wheels can easily be trailed to public sidings for unloading from cars to trucks.

Fig. 3. This shows entire conveying equipment required by small retail coal yard. The portable bucket elevator is used to reclaim coal from pile and loads it direct to truck.



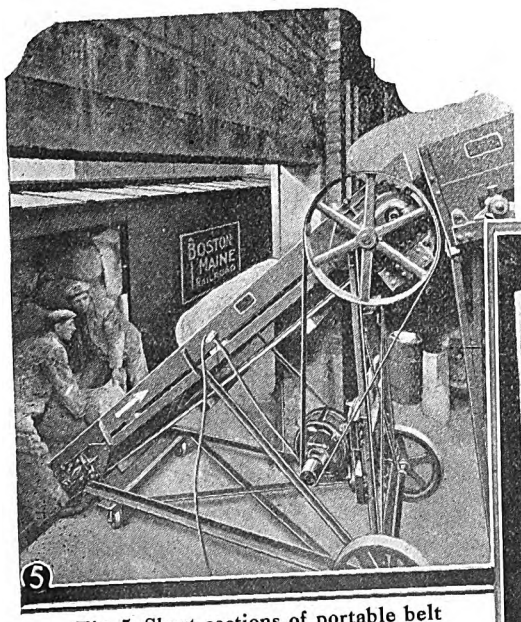
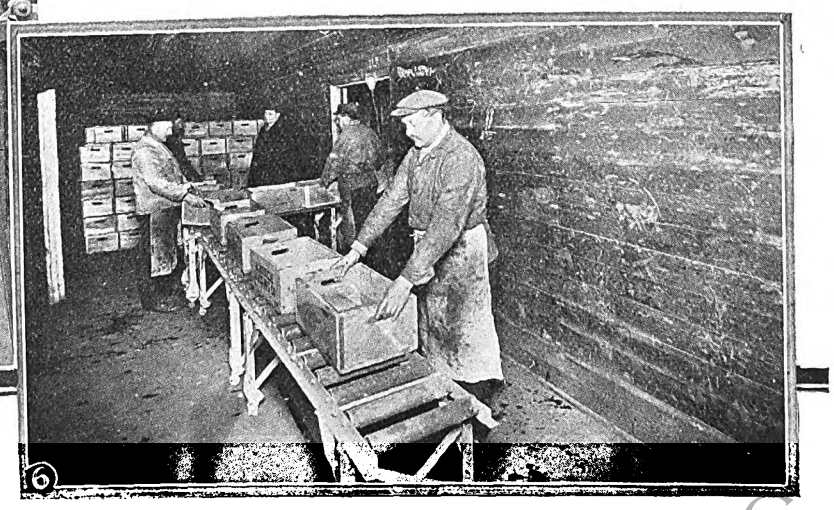


Fig. 5. Short sections of portable belt conveyors materially assist in unloading sack goods from cars, and delivering to plant conveying systems.

Fig. 6. Portable sections of gravity conveyor materially assist in loading and unloading case goods from box cars.



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ind the Car Shortage

Avoid Unnecessary Delays

V. POTTS

As the illustrations show, any executives and business men have realized the money avings that can be made if effi- ent material handling methods e used on the loading and un- ading of coal. Figure 2 shows small unit combination which ntirely eliminates the necessity f shovelling large materials om cars to trucks. The piles own in the background have so been handled by the use of additional portable belt convey- rs.

Figure 3 shows a somewhat imilar commercial coal yard, with the addition of a bucket levator loading device for re- laiming the coal from piles and oading it to trucks. This equip- ment permits speedy handling of materials from cars to pile, hereby releasing the cars and eturning them to the railroad for further loading, and also assists the coal dealer in keeping his trucks busy, making more deliveries in a day than would be the case if all the material had to be shovelled by hand.

While these illustrations are shown in commercial coal yards, here is no reason why the same equipment cannot be installed in a number of small industrial plants, where hand methods are now employed. The commercial coal dealer has made so much money in the last few years, that he has started to spend more on mechanical equipment, because he realizes that in this way it is possible to reduce his direct labor expenses, thus acquiring even larger profits.

The unloading equipment shown in figure 4 is a portable

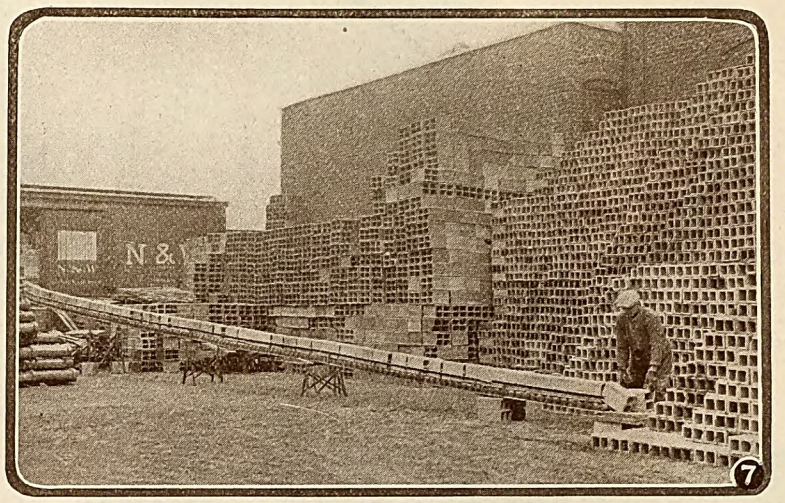


Fig. 7. The simplest car unloader is the gravity conveyor, and is used as shown for handling hollow tiles and building materials, etc.

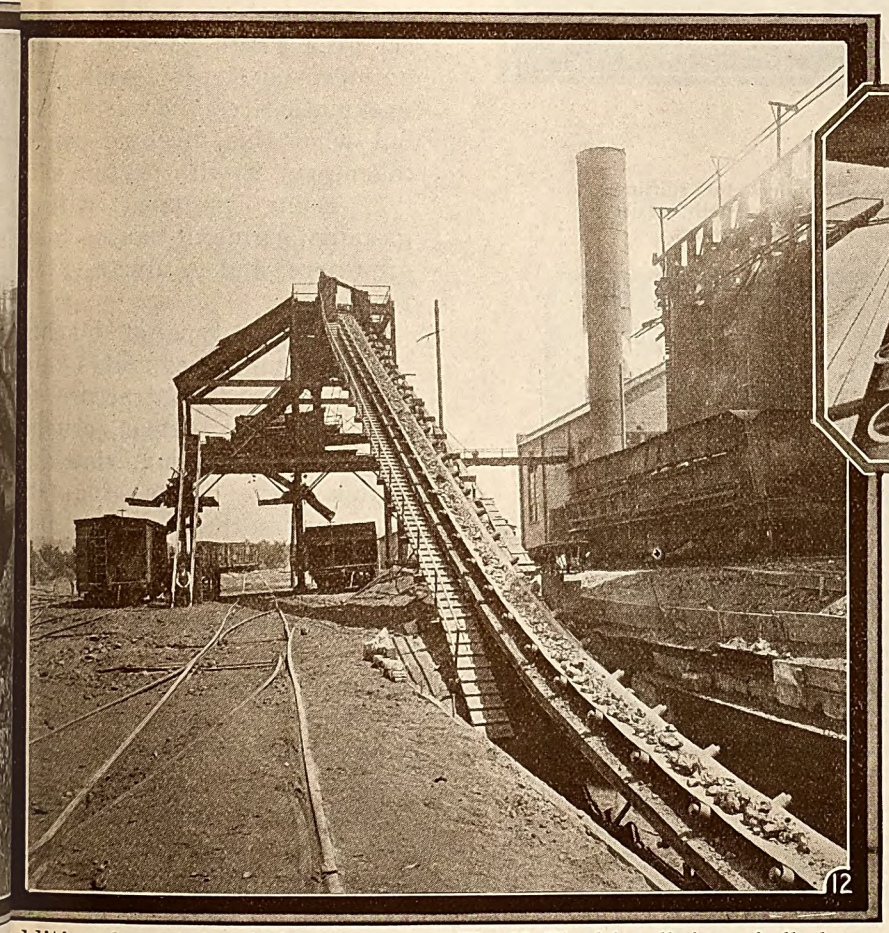


Fig. 12. Fixed installations of all classes of conveyors are frequently used for car loading or unloading.

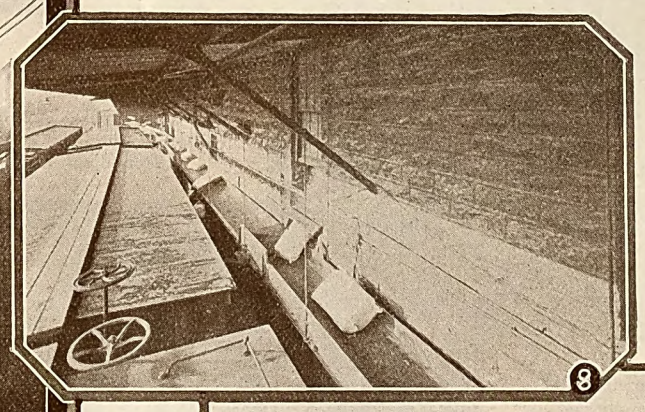


Fig. 8. Belt conveyors are here used as car loaders, conveying the bags from sewing machines direct to individual cars without the assistance of manual labor.

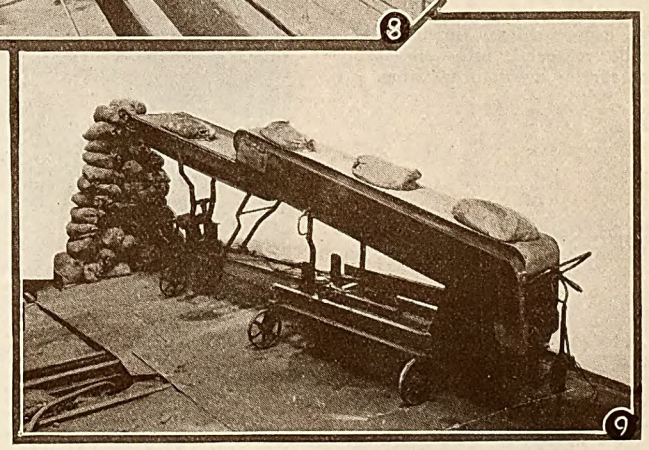


Fig. 9. Extended view of telescopic belt conveyor for loading sacks to box cars.

Fig. 11. Gravity conveyor designed especially for handling shingles for loading to box cars.

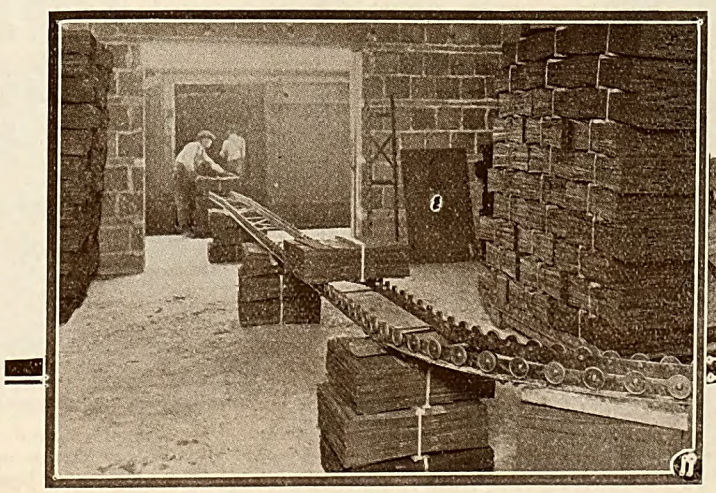
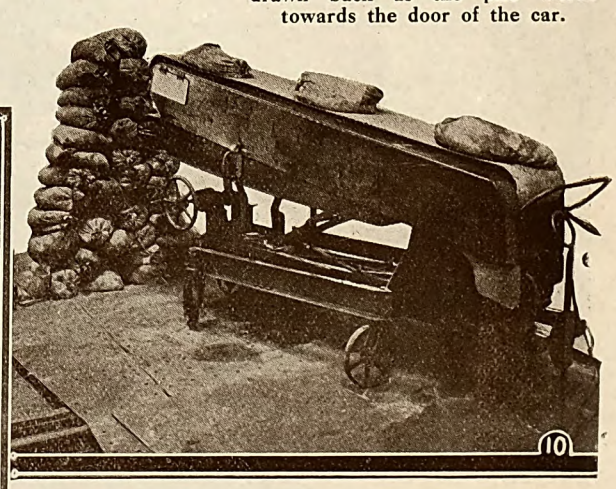


Fig. 10. Same conveyor as shown in figure 9, with telescopic section drawn back as the pile works towards the door of the car.



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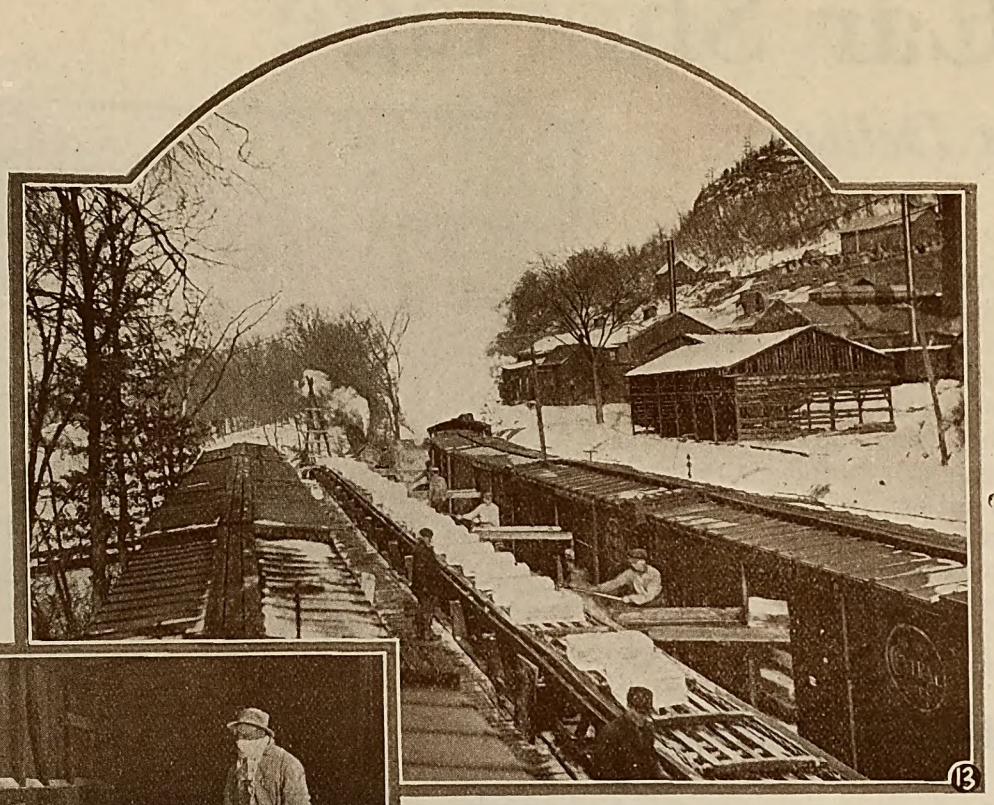


Fig. 13. The operation of loading ice from pond to cars or from ice-house to cars is usually performed by mechanical conveyors.



Fig. 14. Power shovel for unloading bulk material into elevator which carries it to storage bins.

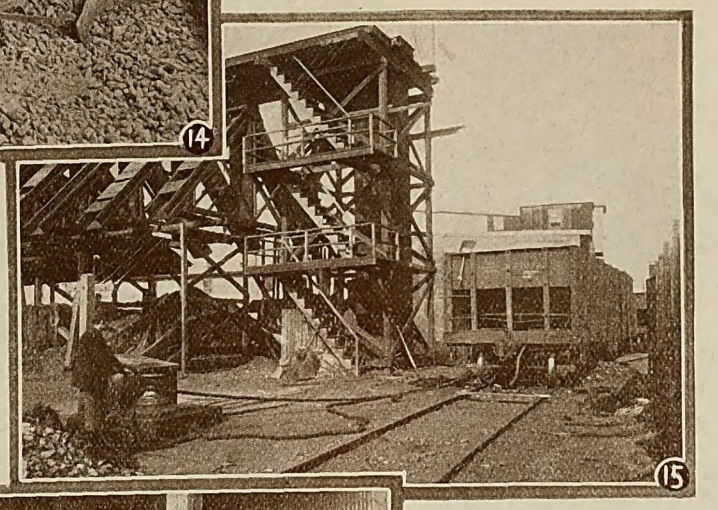
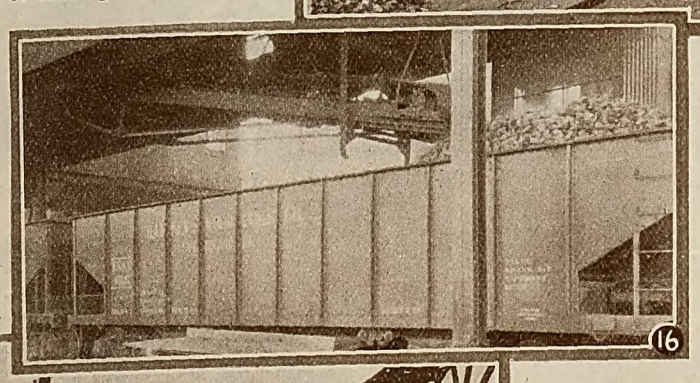


Fig. 15. Power car-pullers for shifting loaded or empty cars materially assist mechanical unloading devices.

Fig. 16. Belt conveyors on adjustable booms are reducing the cost of loading coke.



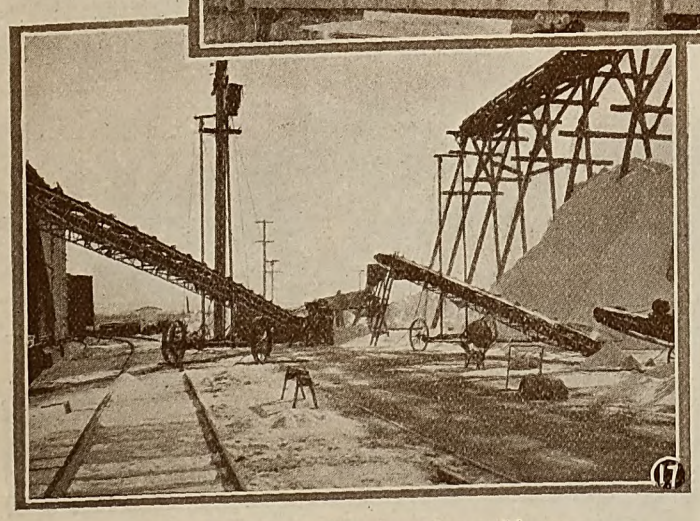


Fig. 17. This combination of portable conveyors handles salt direct from pile, through screens, to box cars as shown with a very small labor expense.

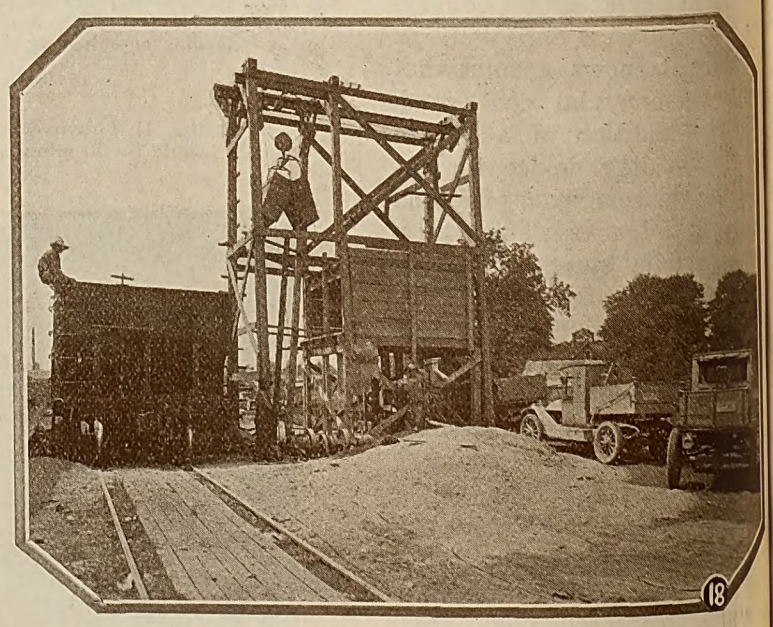


Fig. 18. Simple riggings are frequently large money savers, as was the case of this car unloader for handling road building materials.

belt conveyor, driven by a gasoline engine, but instead of being equipped with large iron wheels, and light framework, it has been designed with a heavier framework and axle upon which Ford truck wheels with pneumatic tires are mounted. This particular machine was built for the operation which it is performing, namely, unloading hopper bottom coal cars from team tracks into trucks. The idea of equipping it with pneumatic tires was to afford a greater portability. The owner of this machine operates in a very large city, and it is necessary to transport the unloader to the various railroad sidings, located frequently a mile or so apart. With the standard type iron wheels, the trailing of this equipment would not be practical over rough pavements and unimproved streets, while with pneumatic tires, there is no road but what this machine can be taken over it with perfect safety. Being equipped with a gasoline engine, it can be taken anywhere, and is always ready for service.

This same type of machine has been purchased and is being used by several contractors, for handling sand, gravel, crushed rock and similar materials.

Industrial plants are still backward in the use of car loaders and unloaders, although many unique devices are now operating in industrial plants on these important operations. Figure 5 shows a portable belt conveyor handling sacks of material direct from cars to the plant's internal belt conveying system, which carries the sacks to storage. This simple device materially reduces the unloading labor expense, speeds up the

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operation so that a car can be unloaded in about one-third the time that would be required if hand truckers were employed, and in addition, elevates the materials, so that the belt conveyors transporting the sacks within the plant can be suspended from the ceiling, permitting the use of valuable floor space for other purposes. This reduces confusion and congestion in the building through which the materials must pass in going to the storage space.

It is not only in the unloading of sacks that simple devices are employed to good advantage, but in bottling works, particularly in plants manufacturing soft drinks and other light beverages, gravity conveyors have long been employed as means of assisting in the quick loading of cars of finished bottled goods, and the unloading of return bottles or new bottles, for refilling in the plant. Figure 6 is a view in the plant of the Anheuser-Busch Company, St. Louis, Mo., and shows how the gravity conveyor is mounted on caster stands, to assist its portability. By using this conveyor, the time for loading a car is very short, and as many cars have to be loaded in a day, it is necessary to save every minute possible. For shipping this material, refrigerator cars are required, and as these are scarce, it is imperative that they be loaded the same day they are spotted on the plant siding.

Gravity conveyors can also be employed for handling goods direct from box cars to yard storage, as shown in figure 7. The plant executive who is considering the construction of a new building, should give serious



Fig. 19. A view of the simplest car unloader for pig iron, namely, short sections of conical gravity conveyor and manual labor.



Fig. 20. Caterpillar turntable crane equipped with magnet or grab bucket can be used about the yard and for car loading and unloading.

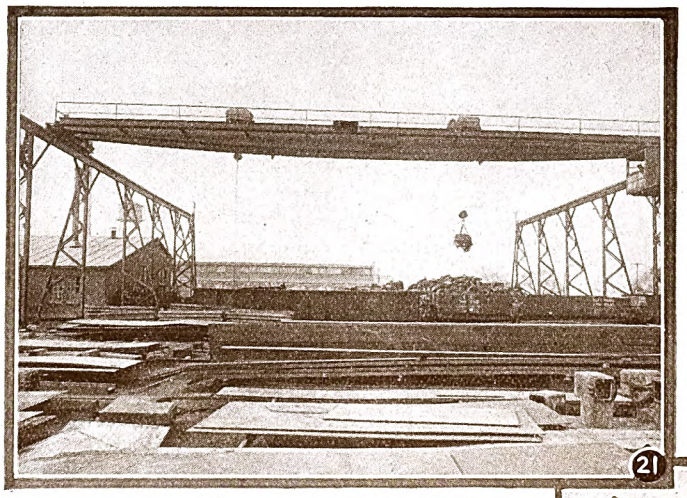
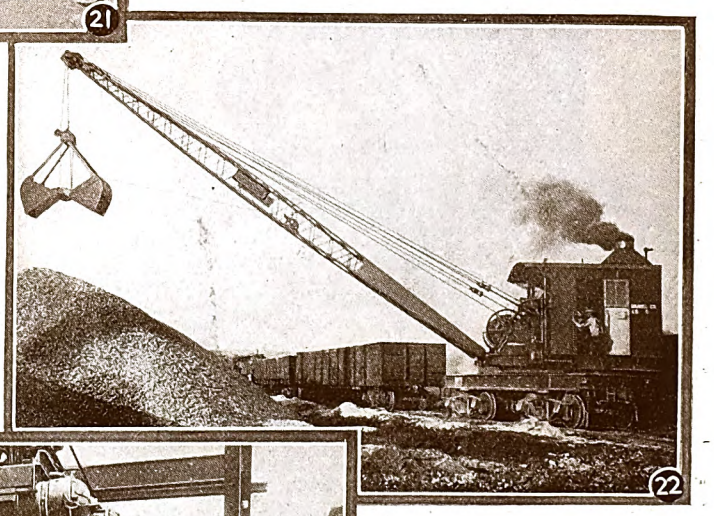


Fig. 21. For pig iron, scrap metal, and large sheet metal, operating over a large yard area, electric travelling crane, equipped with magnet as shown, has been found very efficient, both for car loading and unloading.

Fig. 22. Locomotive cranes with grab buckets are used extensively for the loading and unloading of coal.



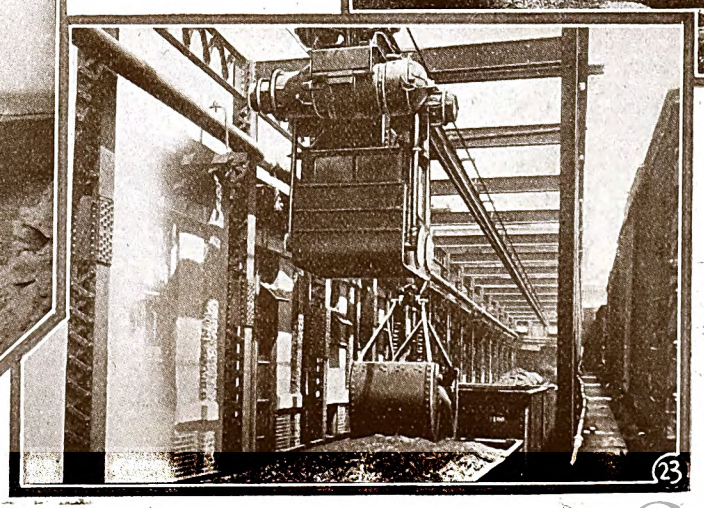


Fig. 23. Cab operated monorail telpher systems with grab buckets make excellent car unloaders in congested quarters.

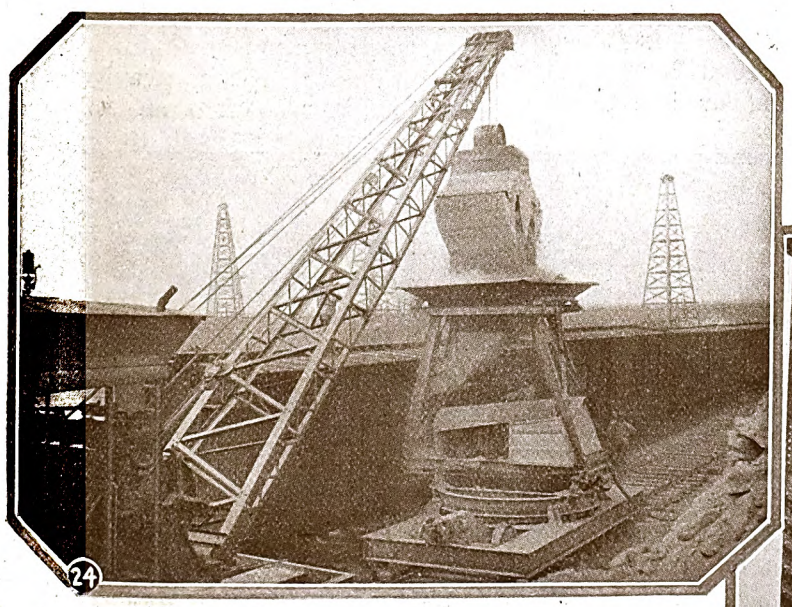


Fig. 24. Loading sulphur from storage pile and placing same in box cars by means of locomotive crane and mechanical car loading equipment.

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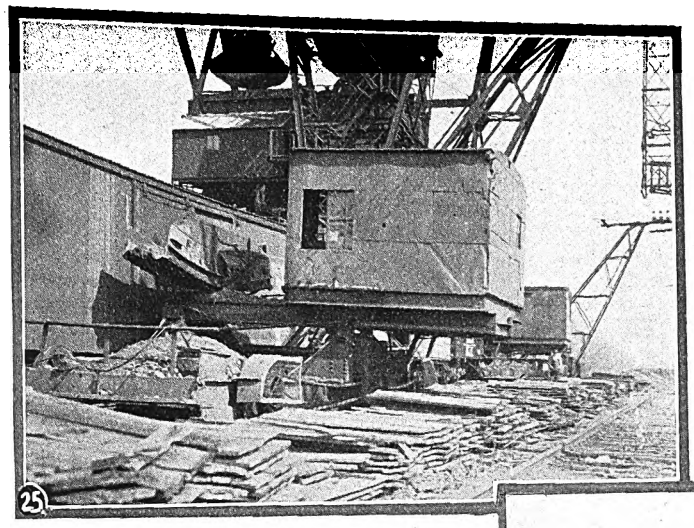


Fig. 25. View showing two pusher-type car unloaders operating at the coal docks on the Great Lakes. The further loader is in the car, while the one in the foreground is withdrawn.

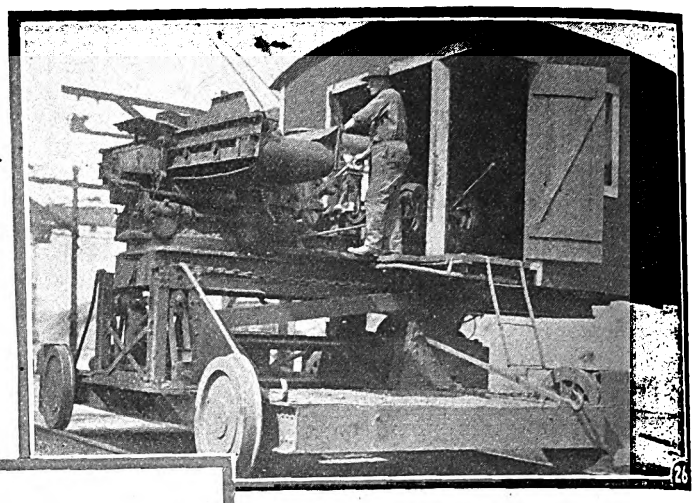


Fig. 26. General view of large tonnage rubber belt box car loader.

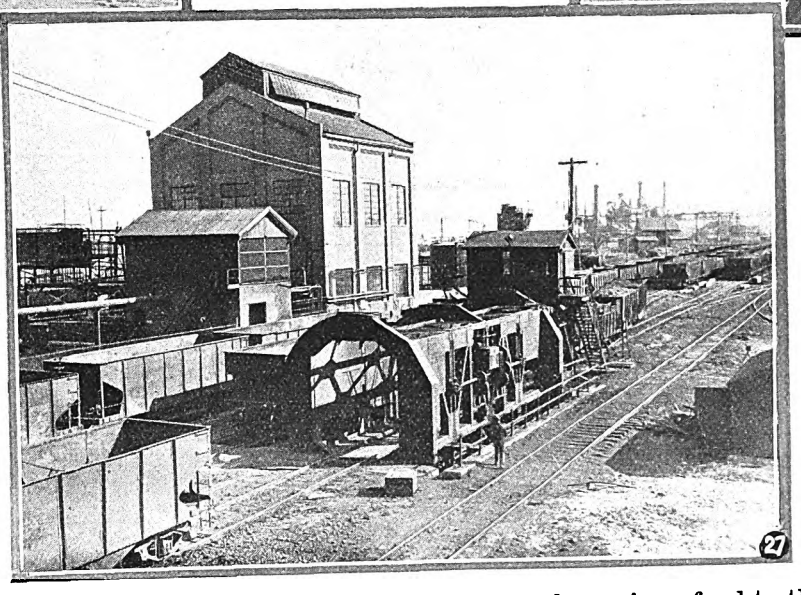


Fig. 27. Rotary car dumpers capable of unloading large gondola cars are now being successfully operated at many plants, terminals, etc.

thought to the use of such simple equipment so as to reduce the handling costs of unloading.

Where large tonnage and several cars are to be loaded in a day, particularly if sacks are being handled, the installation of a flat belt conveyor running the full length of the shipping platform as shown in figure 8, will be found one of the best methods of car loading. It will be noted that several openings feed to this belt conveyor through the side wall of the building. These openings come direct from the sewing machines, after the bags have been filled. By simple scoops, placed diagonally across the conveyor, the bags are diverted down chutes directly into the car for stowing.

In the matter of stowing within the car, where the feed is continuous, handling costs can be further reduced by installing a telescopic portable conveyor as shown in figures 9 and 10. Figure 9 shows the conveyor extended to its full length, for placing the bags at the extreme ends of the car. This saves the man stowing the bags the effort of walking and carrying the bag from the car door to the end of the car when piling. It also permits one man to perform the operation instead of two or three. When the first pile is complete, and it is desired to start a second, third, or fourth pile, working toward the car door, the operator simply turns the hand wheel, thus pulling the telescopic section in under the first section of the conveyor, reducing the over-all length eventually to the shortest possible point, as shown in figure 10.

When the car is filled so that there is no room for the machine to operate, it is removed, and the remainder of the piling can be easily done by taking the bags direct from the conveyor chute as they fall very close to the place where they will be stowed in the car.

For years, the loading of shingles has been done by hand truck methods, as it was practically impossible to find any type of mechanical equipment which would convey the awkward bundles from storage to the cars. Many devices were tried, and eventually it was decided that some form of gravity conveyor would solve this problem. It was found impractical to use the standard roller gravity con-

(*Continued on page* 30)

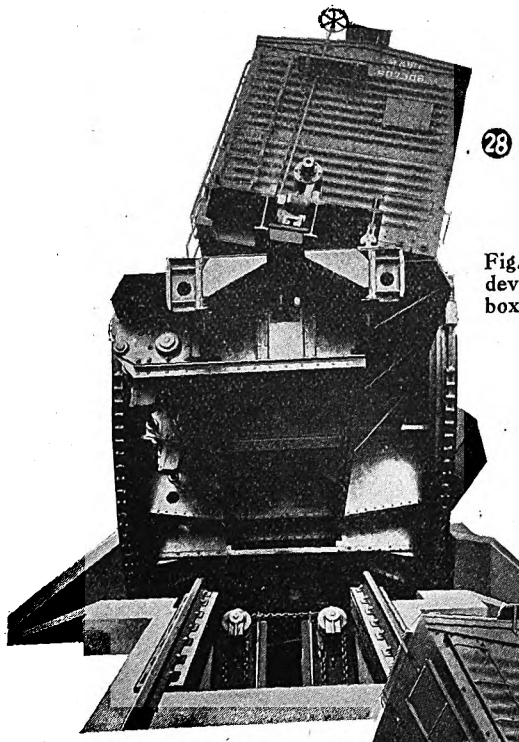


Fig. 28. With this special tipping device, it is possible to unload a box car of bulk material in about five minutes' time.

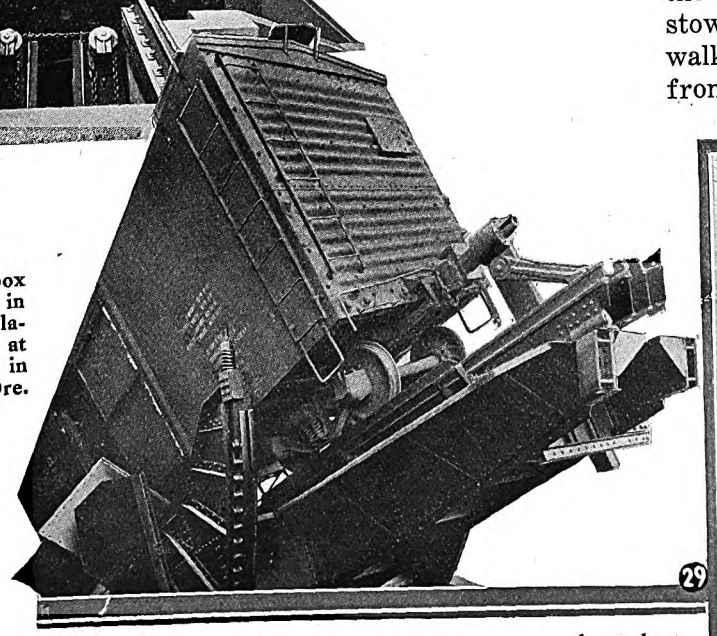


Fig. 29. Side view of box car unloader shown in figure 29. This installation is now operating at municipal pier No. 40 in the city of Portland, Ore.

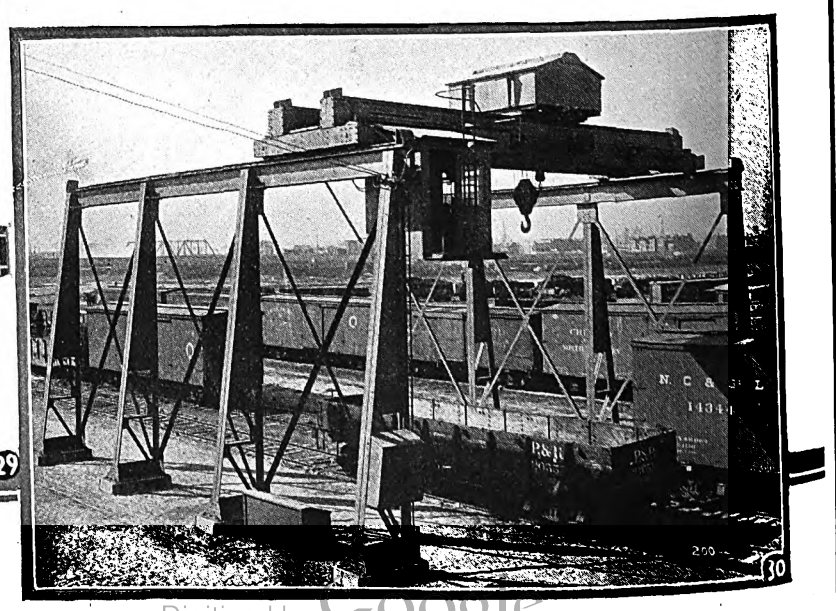


Fig. 30. Special cranes are now located at railroad freight terminals for unloading heavy equipment, etc., from cars to motor trucks or wagons.

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The Oxy-Acetylene Flame in Industry

By J. F. Springer

THE oxy-acetylene process, now in use all over the United States, is nevertheless a comparatively new method. So far as is known to the writer, his own hand-book, published in 1912, was the first considerable treatment of the method on this side of the Atlantic. There are two gases involved, oxygen and acetylene, and this fact is reflected in the name. Both of these gases, in a relatively pure state, are fed through the nozzle and tip. The oxygen in the surrounding air plays no part in the generation of the intense heat produced.

It is possible, under proper conditions, to obtain very high temperatures with the oxy-acetylene torch. Such thermal levels as 5000° and 5500° F. are claimed. And it is doubtless to such temperatures that the wonderful success of the process is due. However, the enormously high temperatures are obtained only in a very restricted region of the flame. This requires explanation. It is advisable, in fact, for the reader to understand roughly what are the reasons for the high concentration of heat.

When the mixture of oxygen and acetylene issues, under pressure, from the orifice of the tip, the acetylene is decomposed by an explosive action into its constituent elements, carbon and hydrogen. This means three substances travelling the same route, oxygen being the third. Apparently, there is little or no recombination for a short interval. But when a distance, measured in fractions of an inch for all the more usual sizes of torch, has been covered, the carbon and the oxygen combine to form carbon monoxide. While the carbon is flowing along in an uncombined state, it shines with a very white light. This little white flame, terminating when the carbon unites with the oxy-



Fig. 1. Welding side seam on section of steel storage tank. The clamps shown hold the rolled plate in position for welding.

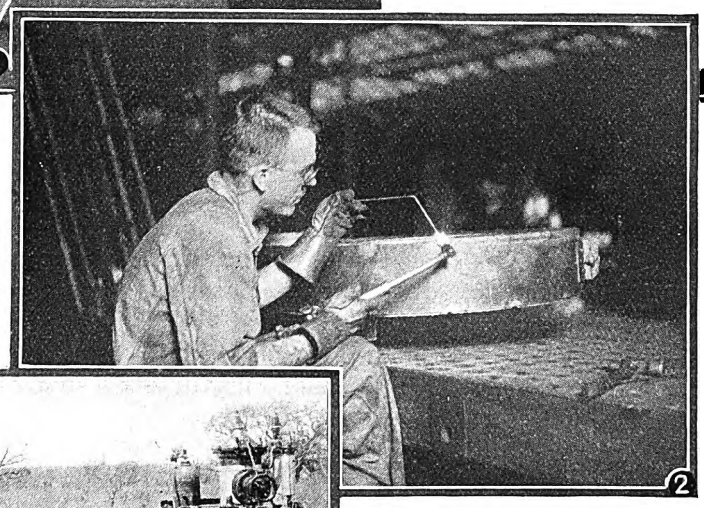


Fig. 2. Machine gear guard being built by welding. Often used pieces of sheet metal may be fabricated into useful equipment by welding.

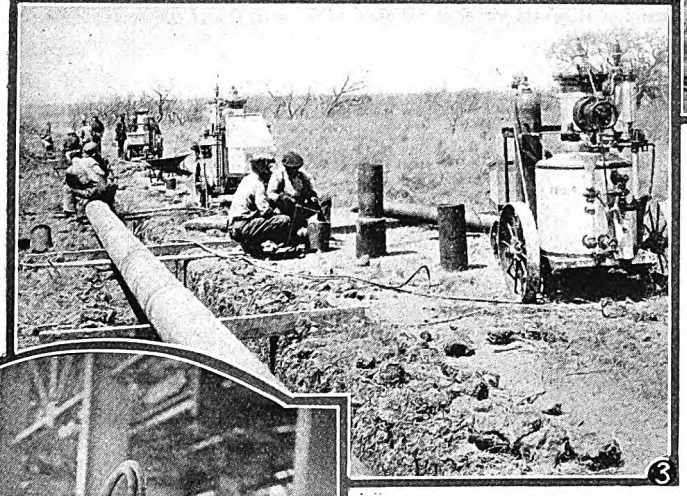


Fig. 3. The welding of oil pipe lines saves time in installation, and prevents loss of material through defective joints. Hundreds of miles of welded pipe are in daily use throughout the country.

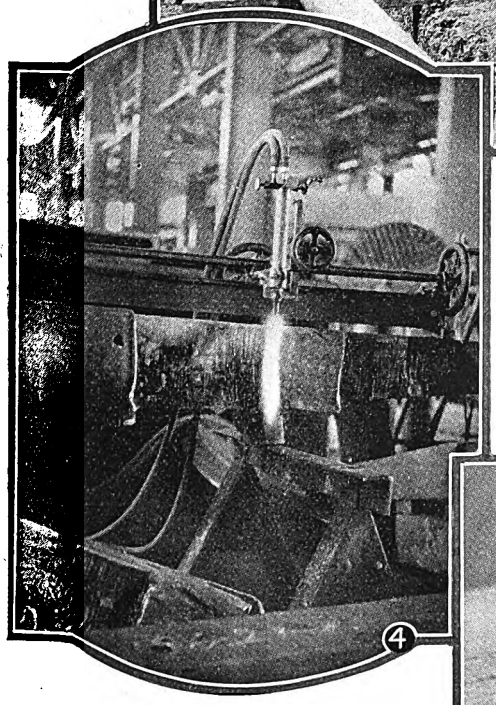


Fig. 4. Cutting rudder for steamship from steel slab with mechanically guided oxy-acetylene cutting blowpipe.

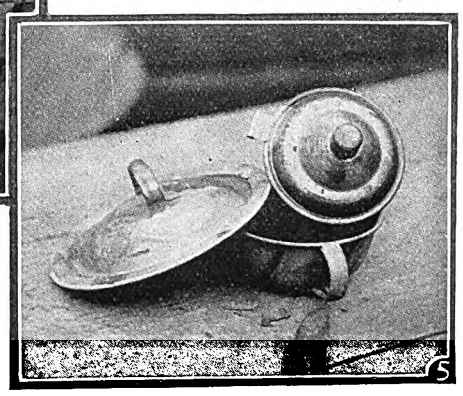


Fig. 5. The handles and attachments of these utensils are oxy-acetylene welded—a vast improvement over soldering.

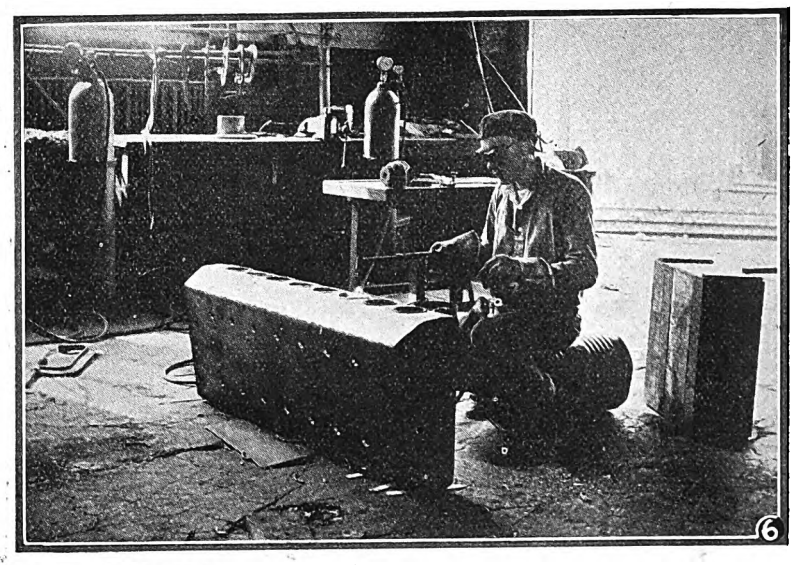


Fig. 6. Welding tubes in smoke consumer. This equipment was made of scrapped sheet and scrapped pipe entirely with oxy-acetylene cutting and welding blowpipes.

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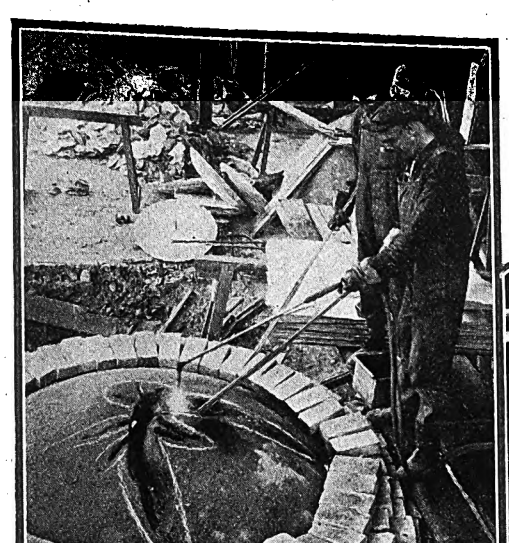


Fig. 7. Cast iron melting pots for lead reduction (similar to the one shown here being welded) are damaged through expansion and contraction stresses in use. By oxy-acetylene welding, they may be satisfactorily and economically repaired. The pot being welded here is the property of a mining company in Mexico.

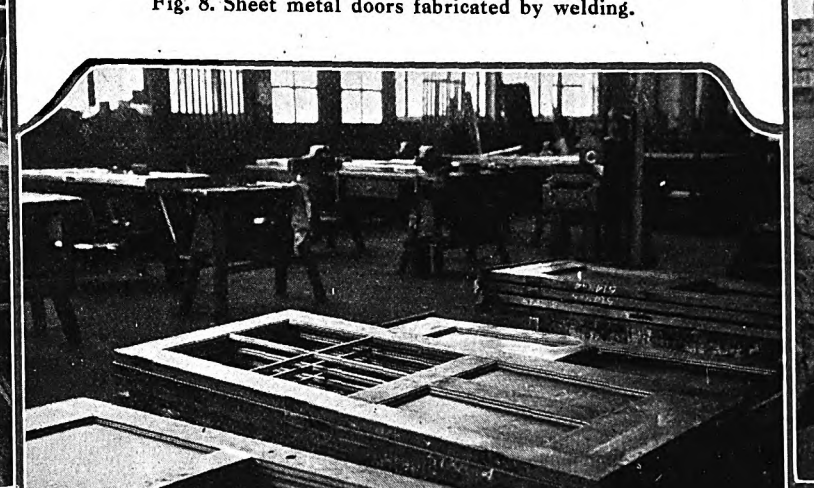


Fig. 8. Sheet metal doors fabricated by welding.

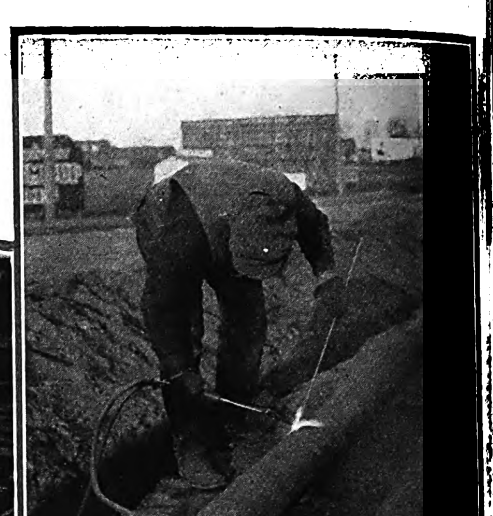


Fig. 9. Welding nipple on all-welded pipe line built to carry city gas under pressure.

gen, is a notable feature of the burning mass of gas constituting the whole flame. At its forward end, or perhaps a trifle beyond, is the hot spot. Here are realized the great temperatures, and here are the metals reduced to the molten state.

The entire flame is quite large, but the envelope, which surrounds the little white flame and the hot spot and extends a very considerable distance beyond, is not excessively hot. In fact, the very hot part of the whole flame is only a small fractional portion.

It is in fact the concentration of a large part of the total heat produced that makes possible such temperatures as 5000° and 5500°. The writer understands this concentration of heat to be the result of limiting the combination of carbon and oxygen to carbon monoxide.

Carbon unites with oxygen to form both a monoxide and a dioxide. In the former case, it is understood that one atom of carbon unites with one atom of oxygen. In the latter, there is a union of one atom of carbon and two of oxygen. In the oxy-acetylene torch, this latter combination is prevented and the former brought about by the limitation of the proportion of oxygen fed through the torch. That is, enough oxygen is supplied to convert the carbon into carbon monoxide, but not enough to convert it into the dioxide. This limitation of the oxygen apparently brings about the high concentration of heat.

There is a similar method which may be termed the oxy-hydrogen process. It uses the two gases oxygen and hydrogen and obtains its heat when they combine. The heat is not so largely concentrated at any one point as is that of the oxy-acetylene flame. It is a good procedure for certain work and is especially useful when, by means of an added oxygen jet, the torch is to be used in cutting steel. But, the oxy-acetylene process has apparently won a superior position in the industrial world. I attribute this largely to the fact of the high concentration of heat at the hot spot.

Ten years ago, there were commercial torches on the market which secured the concentration of heat at the hot spot by using 1.26 or less volumes of oxygen to one volume of acetylene. Theoretically, the proportion ought to be one volume of each. The excess actually required is to be understood as necessary in order to provide for imperfection in mixing the two gases prior to their emergence from the torch. Some torches provide better mixing than do others and in consequence use less oxygen. This is important because of the fact that the less oxygen we use, the less the expense. The matter admits of determination in the

Fig. 10. Cutting rim of huge cast iron fly wheel with oxy-acetylene blowpipe. The metal cut in this case measured 16 by 18 inches.



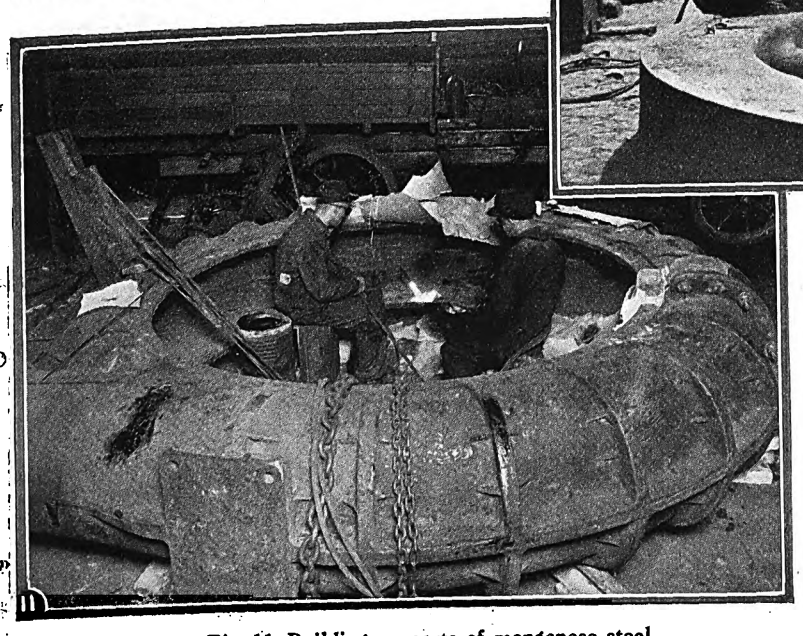


Fig. 11. Building up parts of manganese steel on a casting worn in service.

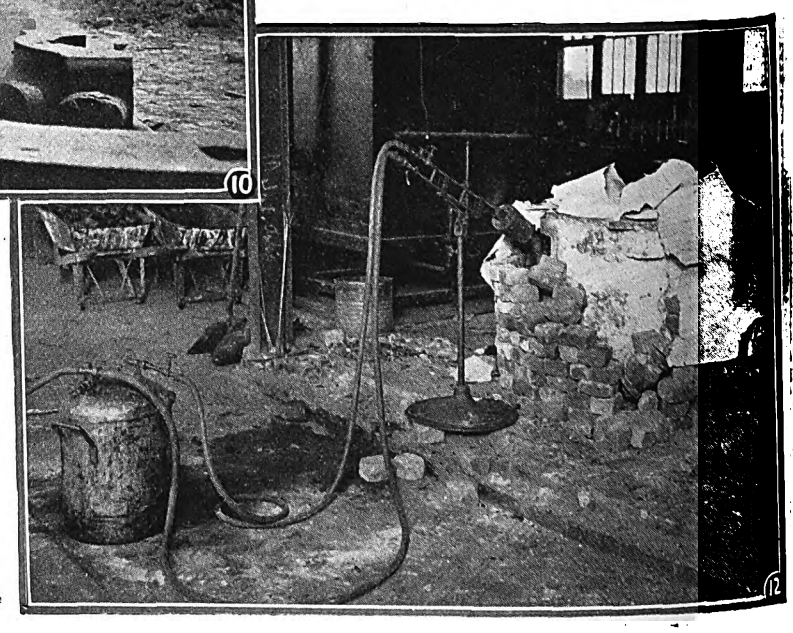


Fig. 12. Pre-heating gray iron casting with oil and compressed air pre-heating unit preparatory to welding.

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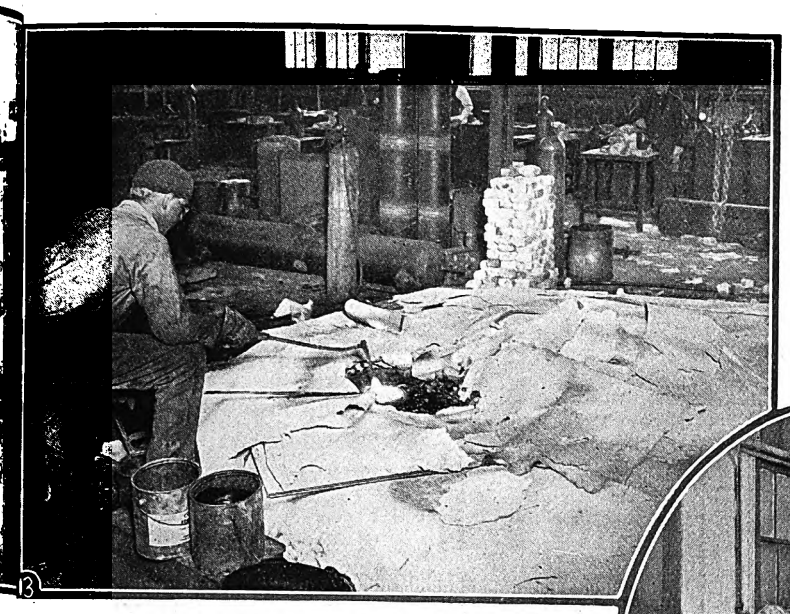


Fig. 13. Welding pre-heated casting. Asbestos paper protects operator from heat of pre-heating fire, prevents radiation of heat and protects casting from drafts.

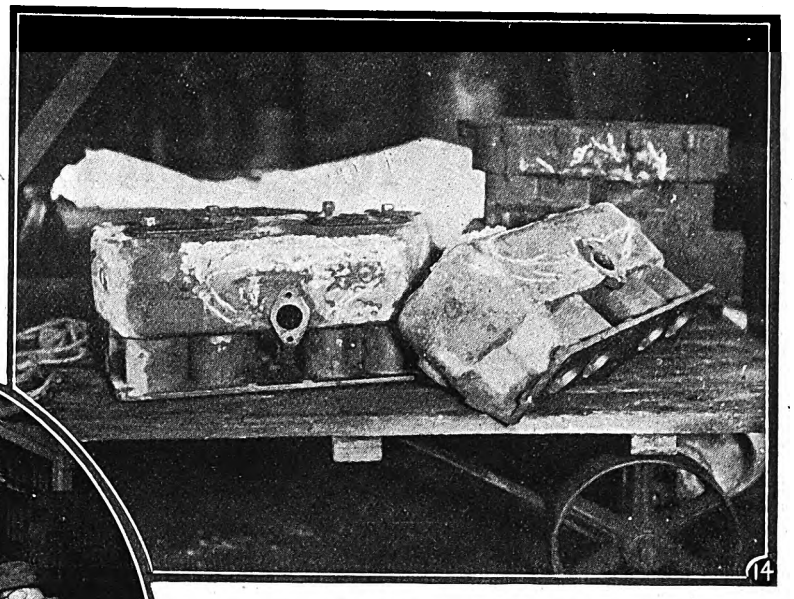


Fig. 14. Defective cylinder block castings welded in foundry.

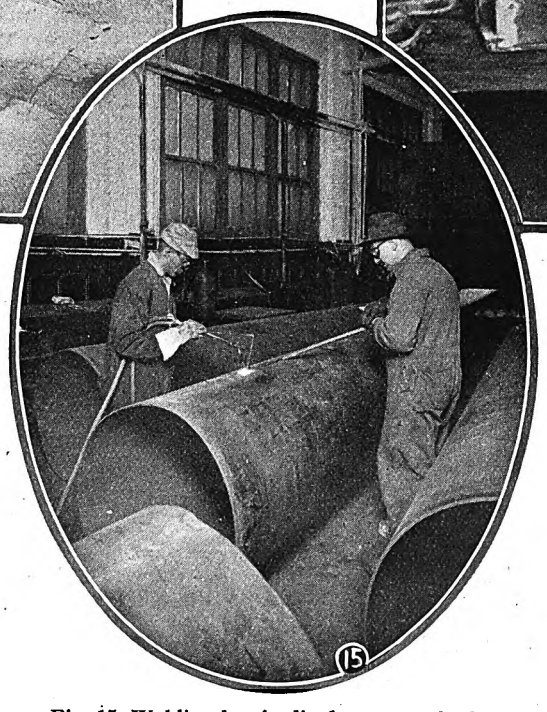


Fig. 15. Welding longitudinal seam on dredge pontoons.

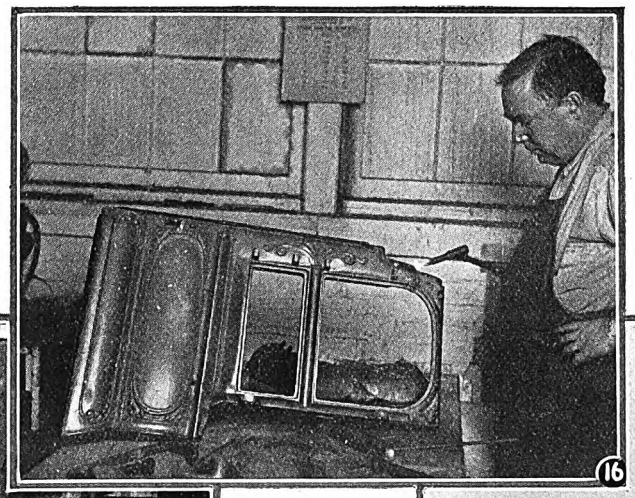
ase of any torch simply by measuring the amounts of oxygen and acetylene used in operating the torch over any interval of time.

In a representative torch, the two gases will be received separately and will be discharged as a mixture. The proportions in the mixture may be regulated by controlling the amounts of the two gases supplied to the mixing chamber. In fact, the appearance of the white flame provides a delicate test which shows when the mixture being formed contains precisely the right proportions. That is to say, the white flame should be single and should also be quite sharply defined. The flame is then said to be normal. It is possible to adjust the torch differently, and to use the abnormal flames produced. Thus, we may use less oxygen than the amount necessary to give the single, sharply defined white flame. In this case, we avoid, more or less perfectly, pouring an excess of oxygen onto the highly heated work. Such a flame is useful in welding copper. But for usual procedures, the normal flame is the one wanted. It is, accordingly, very fortunate that we have an easy and exact method of testing the adjustment. In fact, as the workman goes on with his welding, he is able to detect any change in his flame and to correct it easily and thoroughly, the appearance of the little white flame being a sufficient guide.

The term *welding* is wrongly applied to the process of uniting metal by the oxy-acetylene and the oxy-hydrogen processes. But everybody, pretty much, uses it; so that it is necessary to recognize the extension of meaning. In the old time welding done on an anvil by the blacksmith, two pieces of iron or steel are heated to a temperature round 1900° F., and then

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Fig. 16. Broken stove pattern being repaired.



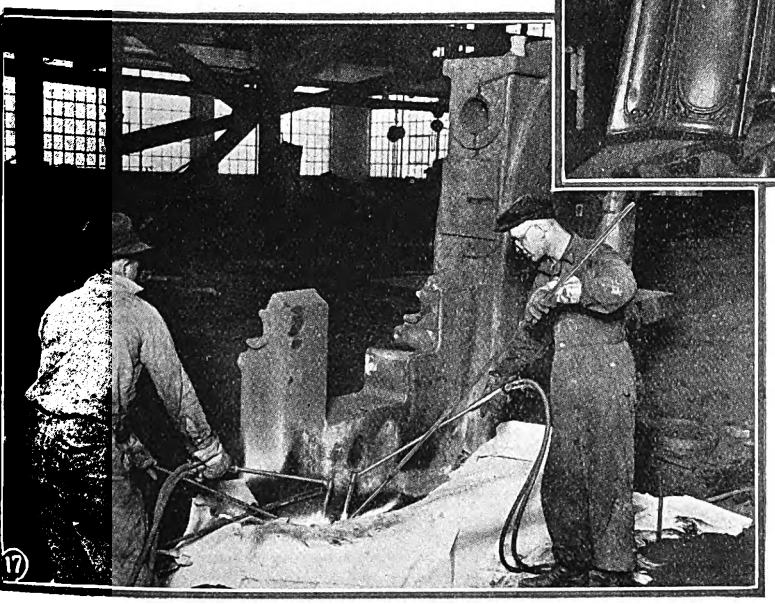


Fig. 17. Punch press frame damaged in use, quickly returned to service by oxy-acetylene welding.

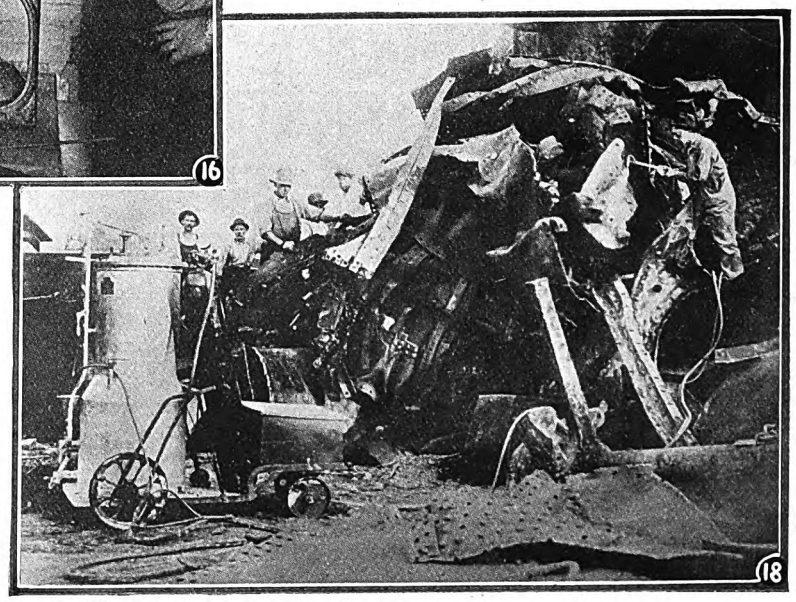


Fig. 18. Cutting up twisted steel wreckage, for removal; a job which has been greatly simplified through the acetylene flame.

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Making Steam Do Double Duty

Power and Heat from Exhaust Steam

By James T. Beard, 2nd

In previous articles we have pointed out the necessity for economy in the generation of steam power in the boiler house, if the steam department of the industrial plant is to be placed upon the same sound and businesslike basis as other departments of the mill. This same principle of economy must equally apply to the use of the steam generated, not only in the many industrial and heating processes, but also in the engines and turbines, which develop mechanical and electrical power for turning the wheels of the plant.

In the central station the economical use of the generated steam presents a simple problem, since the only service to which it is put is for driving the prime movers and auxiliaries. The multiplicity of uses for steam in the industrial plant, however, together with the wide variations in the steam demand and power requirements, make the problem more complex.

The chief steam problem in the average industrial plant is what to do with the exhaust steam. Operating engineers know that by far the greatest amount of heat in steam at any given pressure is that heat which must be put into it, in order to convert it from water into the vapor state. After water has once been changed to steam, the addition of only a comparatively small quantity of heat is sufficient to raise its pressure from atmospheric up to the operating pressure of the boilers. Roughly speaking, steam that has been exhausted from the engines has nearly 90 per cent. as much heat in it as was present in the live steam before it entered the engines. In other words, in the development of engine or turbine power, only 10 per cent. of the total heat in the steam is used, when the steam is exhausted to the atmosphere.

If this exhaust steam is permitted to go to waste, therefore, the corresponding loss amounts to a very considerable proportion of the amount of coal burned. One way of conserving this heat is by forcing the steam to surrender more of its heat during its expansion in the engine cylinder or in the steam turbine. By doing this the prime mover is made to develop a greater horsepower for the same amount of steam, or the same horsepower for a considerably less amount.

This reduced steam consumption, or increased engine economy, is accomplished by reducing the back pressure on the engine. In other words, a vacuum is created on the exhaust side of the piston, so that the pressure of the live steam on the other side forces the piston ahead against less resistance. The lower the back pressure, the greater will be the steam expansion, and the more work will be done by the engine when using the same weight of steam.

With suitable apparatus the back pressure on any engine or turbine may be reduced to a point far below the normal at-

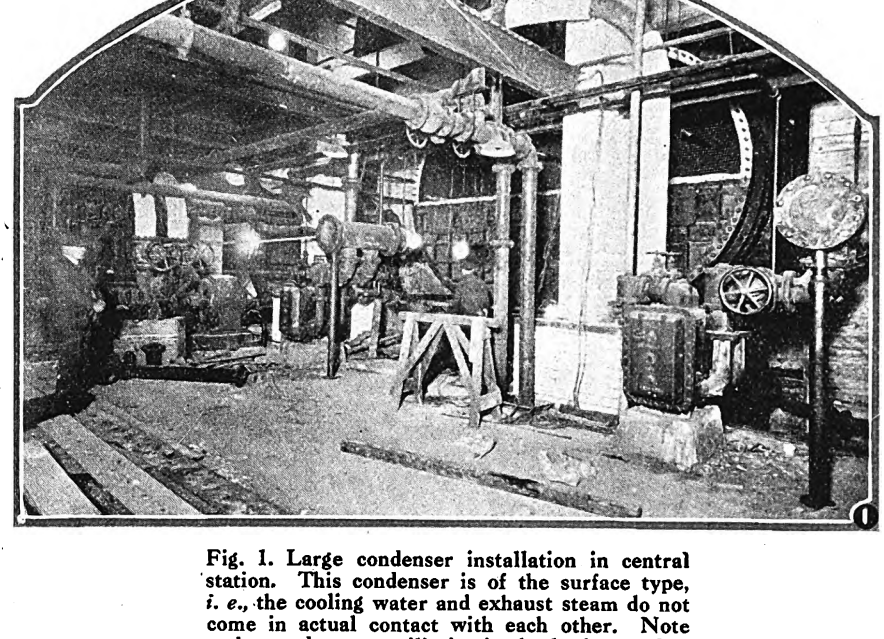


Fig. 1. Large condenser installation in central station. This condenser is of the surface type, *i. e.*, the cooling water and exhaust steam do not come in actual contact with each other. Note the condenser auxiliaries in the background.

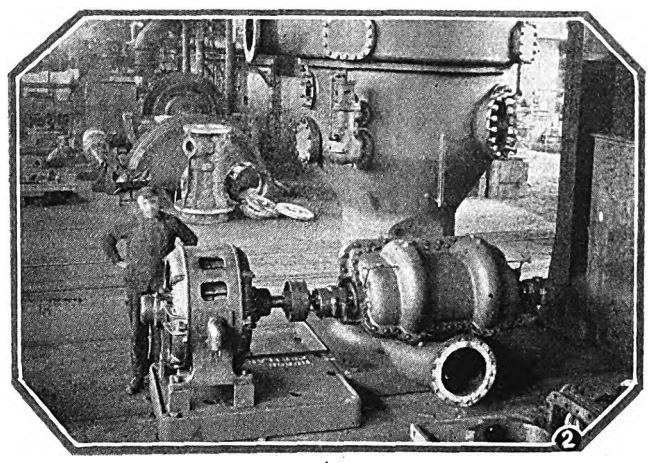


Fig. 2. Vertical jet type of condenser with motor-driven double runner removal pump. In this type of condenser, the cooling water and steam are mixed.

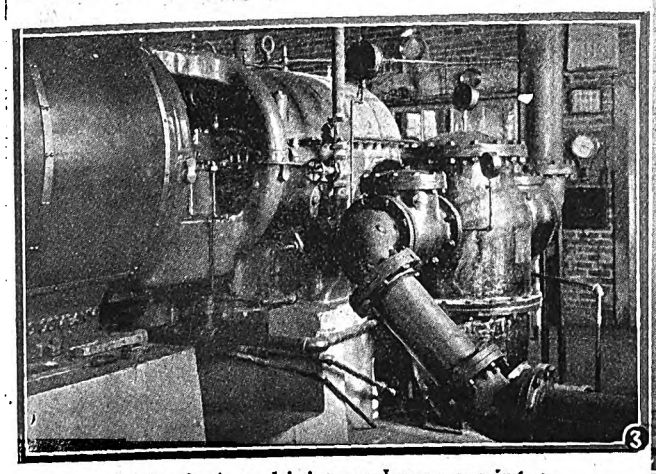


Fig. 3. A multi jet condenser serving a 300 kw. turbine, driving an electric generator.

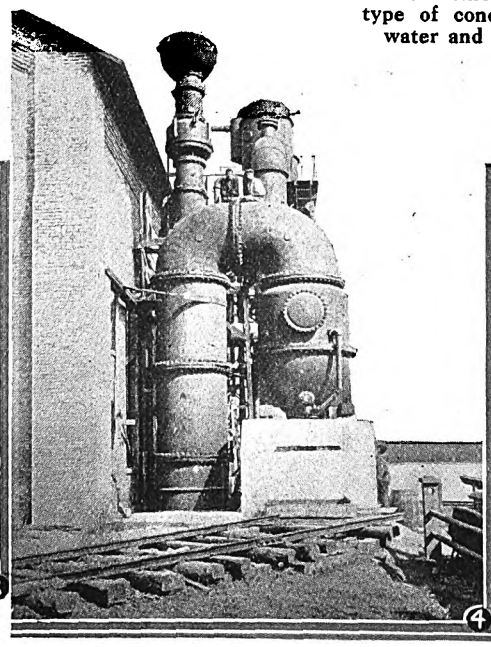


Fig. 4. Large jet condenser installation at the Dominion Coal Company, Nova Scotia.

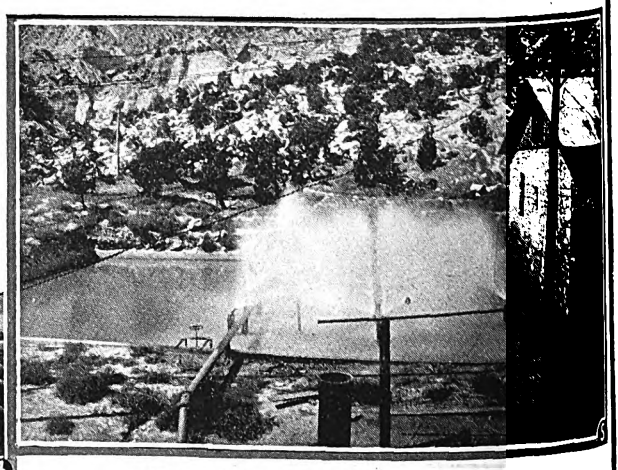


Fig. 5. Where conditions make it necessary to use cooling water over and over again, it is often effectively cooled by spraying it into a pond or reservoir. The resultant evaporation lowers the temperature.

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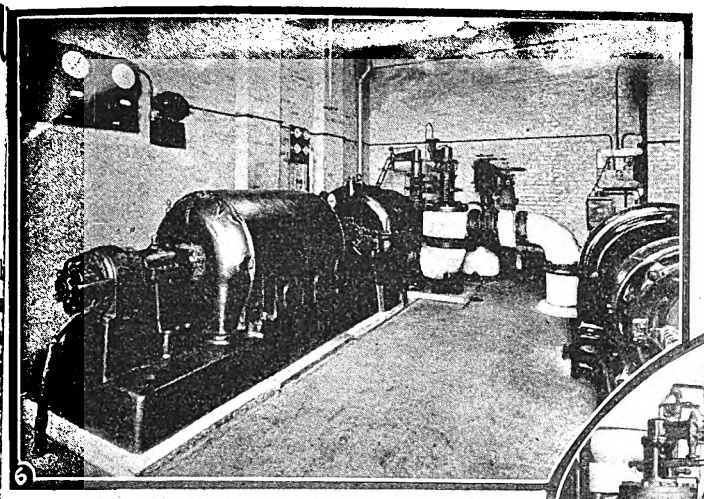


Fig. 6. A mixed pressure type of turbine operating at 28 inches vacuum, and driving a 500 kw. electrical generator.

Fig. 8. A bleeder type of turbine installed in the paper manufacturing plant of C. H. Dexter and Company. The low pressure end of this turbine exhausts into a 28-inch vacuum. Steam for heating may be bled from the intermediate stages of this turbine, after having developed power by expansion in the high pressure stages.

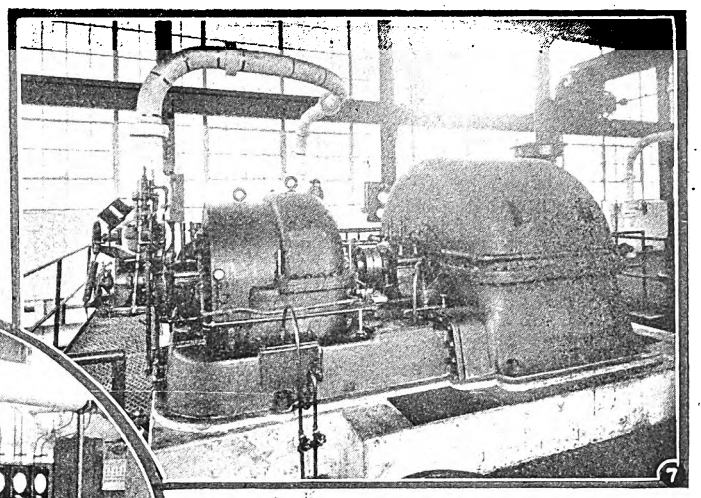
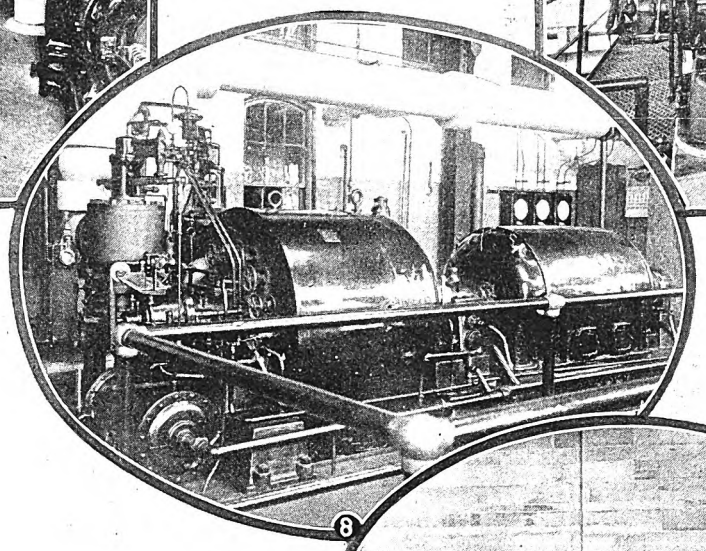


Fig. 7. Twenty-eight inches of vacuum means almost zero back pressure on this turbine. A perfect vacuum at sea level would read 29.92 inches on the mercury barometer.



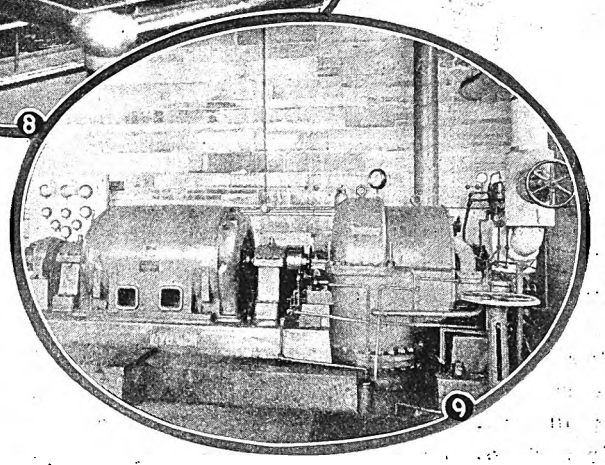
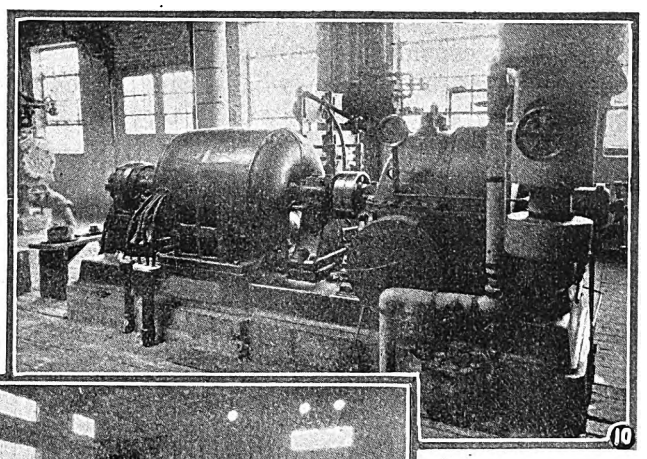


Fig. 9, A small turbine such as is adapted to industrial power service. This unit operates on 175 pounds pressure, 100 degrees superheat and at 27 inches vacuum. It drives a 500 kw. generator.

Fig. 10. Many industrial plants have found condensing turbine installations economical. The illustration shows a condensing turbo-generator set operating in the plant of the Sutherland Paper Company, Kalamazoo.



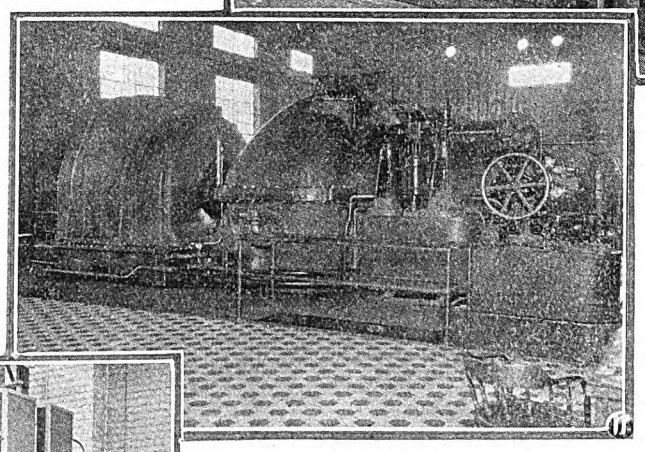


Fig. 11. Condensing turbines are especially economical in central stations where the units are large, and high superheat and vacuum are available.

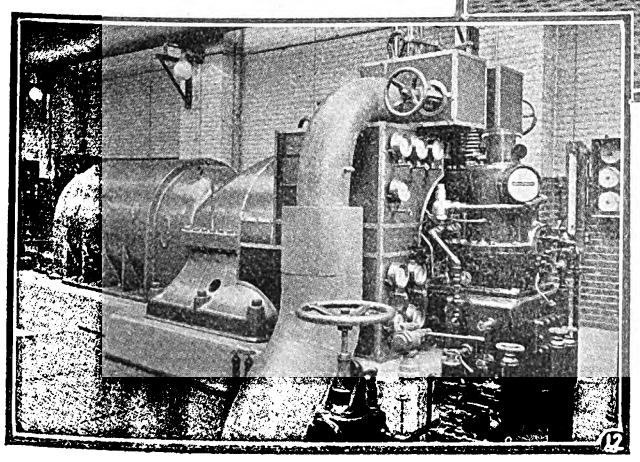


Fig. 12. Although the steam turbine may be less economical than the well designed Corliss or Unaflow engine when operating non-condensing, it is probably the most economical steam prime mover when operated in conjunction with an efficient condenser installation.

mospheric pressure. The principle involved is the sudden condensation of a large volume of steam as it is exhausted from the engine or turbine. In the liquid state the condensate occupies only 1/1700 of the original volume of the steam. If there is no inleakage of air, the space it formerly occupied remains absolutely empty and a vacuum is produced, tending to suck out the other exhaust steam from the prime mover into the unfilled space in the condenser.

The economy effected when operating a reciprocating engine on the condensing principle may be 20 to 30 per cent. greater than when operating non-condensing. In the case of steam turbines the gain in economy is even more.

Condensers are of two general classes, each of which is adapted to certain plant conditions. In each class there may be different types, according to variations in design to meet special operating conditions. Jet condensers are so called because the condensation of the steam is accomplished by mixing it thoroughly with a jet of cooling water, which is sprayed into the condenser. The water mixes with the steam and literally absorbs it. The mixture of cooling water and condensed steam is removed from the condenser by suitable means as fast as it accumulates.

In the ordinary type of jet condenser the cooling water and condensed steam are removed by means of a vacuum pump. Such a pump is designed also to handle any air that is carried into the system by the cooling water. Some designs provide a removal pump to handle the water alone and an air pump for exhausting the air.

In the barometric jet condenser, the water is removed by the gravity action of the barometric column. No water pump is needed. A dry air pump is required, however, to remove any air that is caught in the system.

Ejector condensers provide for the removal of the water and air by the kinetic energy of water jets. High vacuum is secured without the use either of an air pump or removal pump.

The second general class of condensers includes those types which condense the exhaust steam by means of cooling water, without permitting them to mix. This type of condenser is known as the surface condenser and consists of a cylindrical shell or steam space, in which are placed a large number of small tubes.

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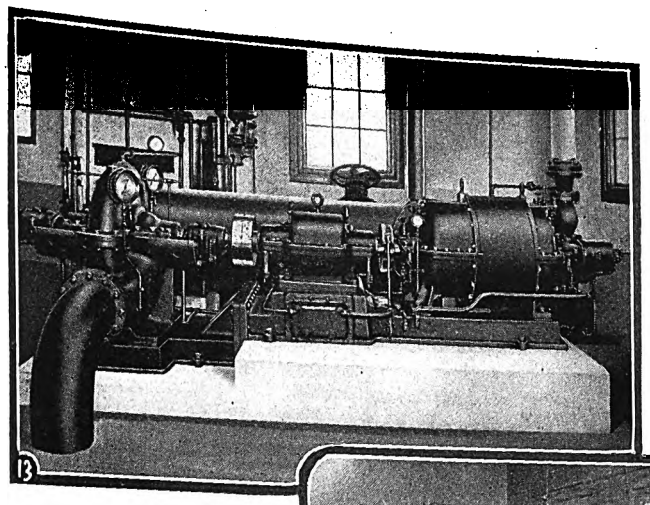


Fig. 13. A 220 hp. steam turbine of the condensing type operating at high speed and driving centrifugal pump through a suitable double helical reduction gear set. By properly designing the reduction set, both turbine and pump are made to operate at their most economical speeds.

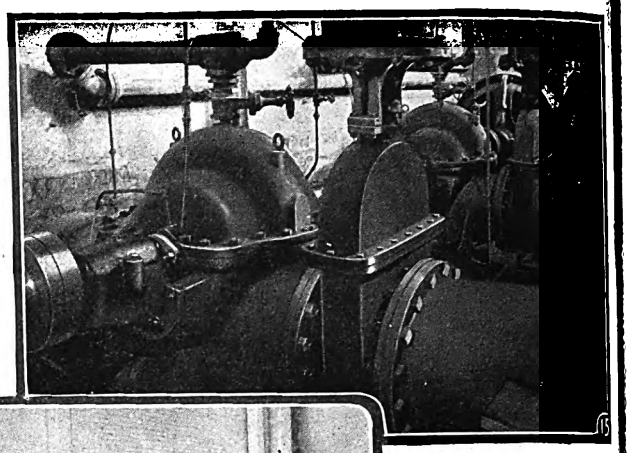


Fig. 15. Motor-driven circulating pumps which supply cooling water for condenser service at the plant of the Marquette Cement Company.

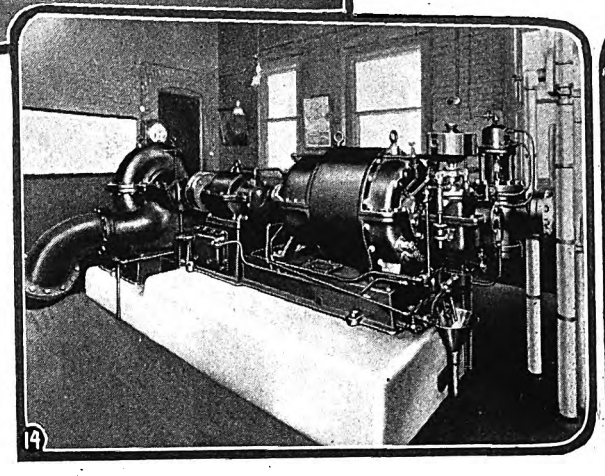


Fig. 14. Condensing steam turbines are especially adapted to centrifugal pump service. Constant speed and load make their operation most economical.

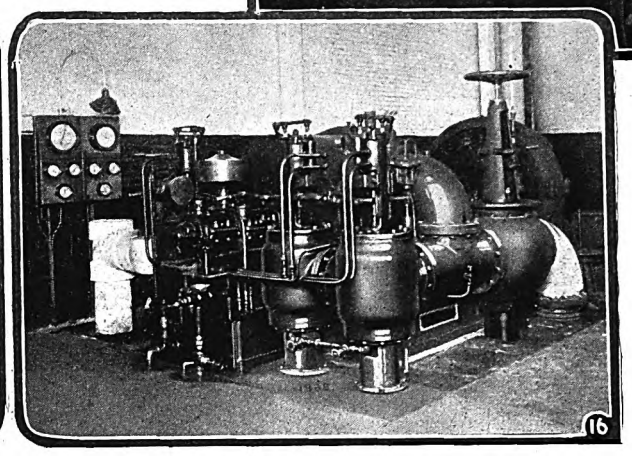


Fig. 16. Combined mixed flow and extraction turbine in a large industrial plant in New England. This type of turbine is especially adapted to industrial power service, since it permits the extraction or bleeding of low pressure steam from the turbine for heating and industrial purposes.

Cooling water is circulated through these tubes, absorbing heat from the steam much in the same way that water in a steam boiler absorbs heat from the furnace gases. The cooling of the exhaust steam causes condensation and a vacuum is produced. The condensate and entrained air must be removed by suitable pumps.

No matter what type of condenser is used, power of some sort is required for the removal of the water and air from the system, or for the circulation of the cooling water. Against the increased economy of the engine, therefore, must be charged the power required to operate the necessary condenser auxiliaries. As a general rule, these auxiliaries will use from 8 to 10 per cent. of the total steam used by the prime movers.

The load factor in each individual plant will determine to a large extent the degree of vacuum best suited to each. installation. By load factor is meant the ratio of the actual yearly capacity developed by the prime movers, to the rated yearly capacity of the plant. The reason for this is that the fixed charges go on, whether the plant is running or not, while the gain due to a higher vacuum is realized only when the engines or turbines are operating.

In industrial plants the load factor varies considerably. As a general rule it is somewhat above 40 per cent. If the load factor is low (say 10 per cent. or under) the plant should undoubtedly be operated non-condensing, unless coal costs are exceedingly high. This is particularly true of plants where only one engine is in service. It may not be true, however, where more than one unit is used to carry the load. In the latter case, considerable economy may sometimes be effected by operating one or more of the units condensing. The engines carrying the steady day load should run condensing, while the unit carrying the peak should run non-condensing.

The selection of the proper condenser for any given plant will depend upon the conditions existing at the plant. Where there is a plentiful and cheap supply of good, cooling water, such as would be suitable for boiler feed purposes, some type of jet condenser might be found most desirable, providing a very high vacuum is not essential. Where overhead room permits the tall barometric type of condenser will perhaps give satisfactory service at a low first cost. Where cooling water is very dirty a siphon condenser may be required.

With the surface condenser any cooling water of reasonable quality may be used. The only restrictions are that it must not be so dirty as to seriously impair the efficiency of the cooling surfaces by coating the tubes with sediment and muck. With this type of condenser pure, softened boiler feed water is reclaimed from the condenser and

(*Continued on page 37*)

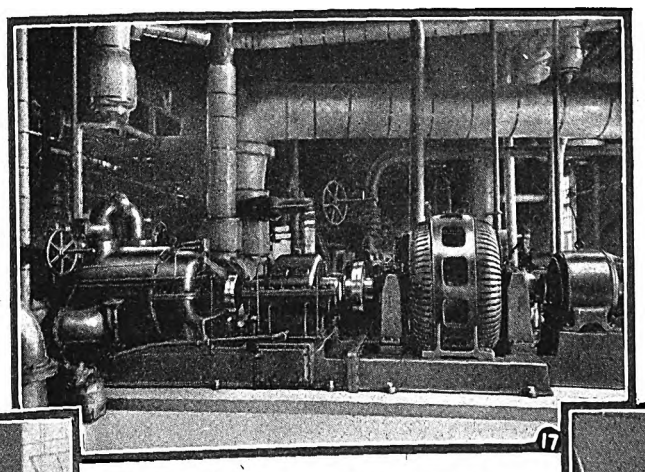


Fig. 17. High speed condensing steam turbine, driving an alternator through a reduction gear set.

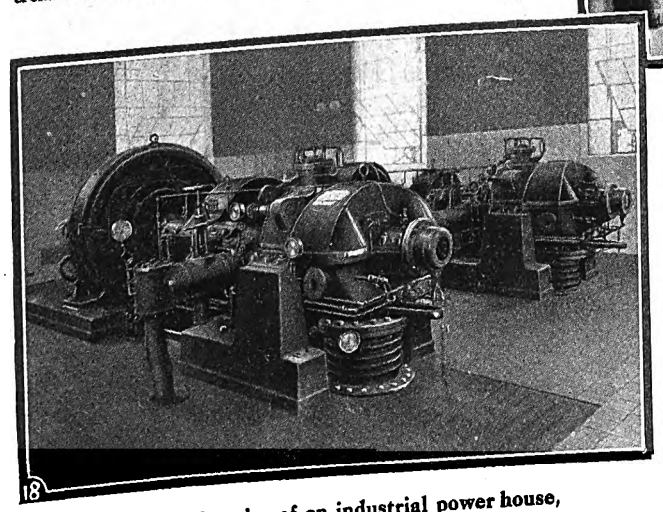


Fig. 18. Interior of an industrial power house, showing two condensing turbo-generator sets.

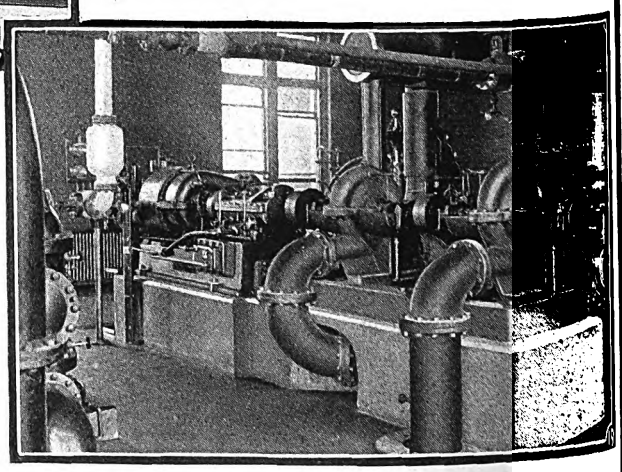
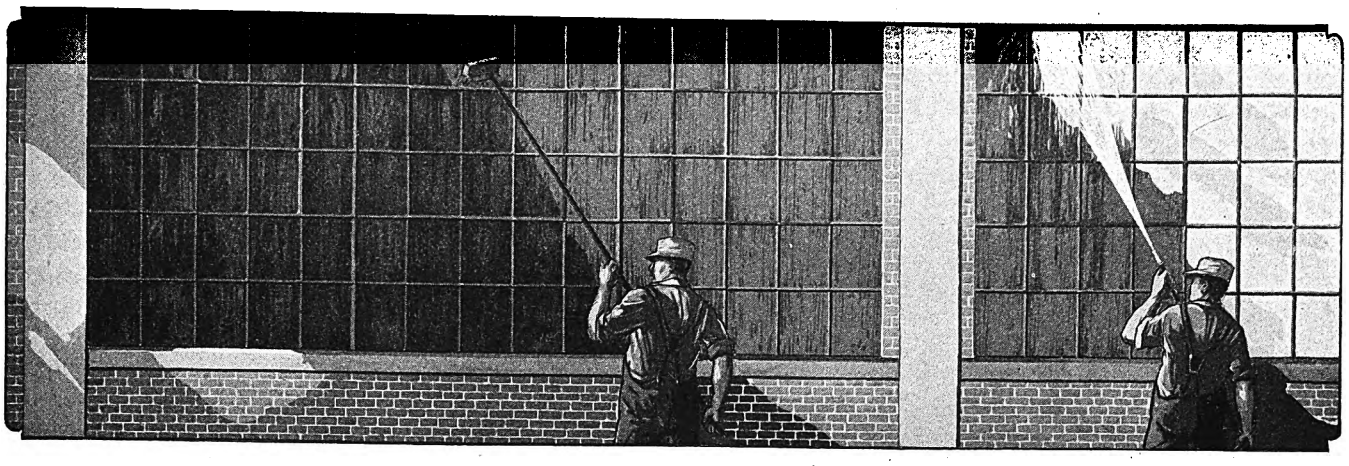


Fig. 19. Water supply stations find condensing steam turbines very economical prime movers in conjunction with centrifugal pumps.

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(1) *Glass encrusted with rust, carbon scale, etc., cannot be cleaned by ordinary methods.*

(2) *Yet when coated with Skybryte the crust of rust, soot and scale is almost instantly dissolved.*

(3) *Flush off with water, using hose where practical, the glass is clean and daylight enters.*

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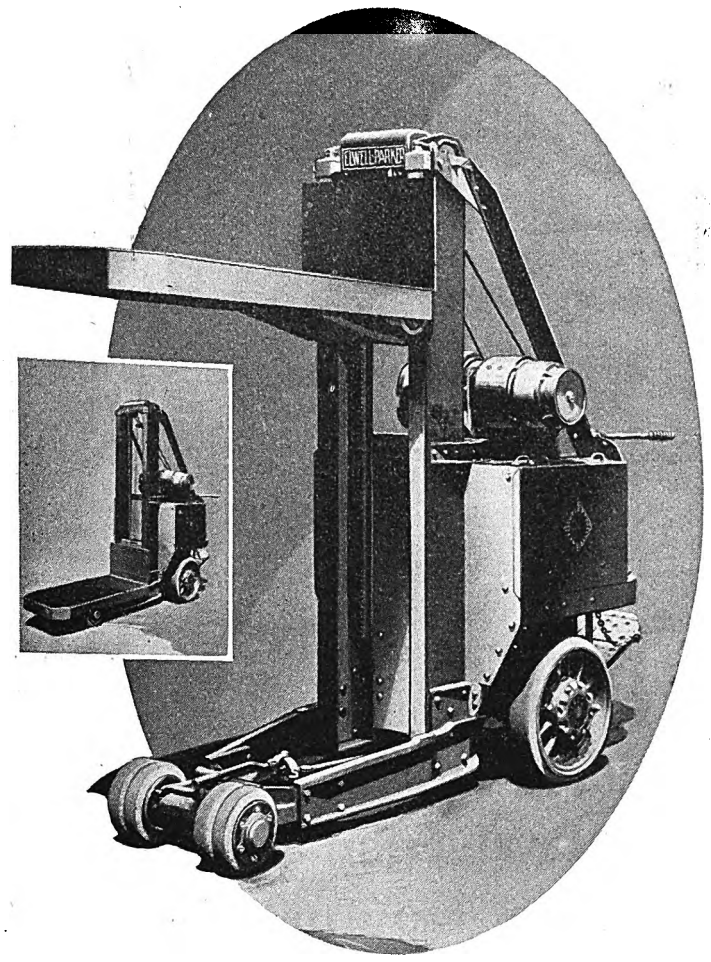
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Mechanical Handling and the Car Shortage

(*Continued from page 22*)

veyor, but after much experimental work, a special gravity conveyor, shown in figure 11, was designed and built, and is now operating in the plant of the Transfer Stained Shingle Co. Inc., North Tonawanda, N. Y.

With the conveyors as shown, and by using a curved section in the car, and another curved section at the pile, two men can easily do the work that three men did before the conveyors were installed, and when the pile of shingles to be loaded is in the center of the building, there is a greater saving.

Furthermore, the men can do their work more easily, speedier, and there is no carrying of the bundles of shingles.

The foregoing illustrations have shown equipment used for handling package or small bulk materials. It cannot, however, be overlooked that many conveyor installations such as that shown in figure 12, are really car loaders. Here, by the simple arrangement of an inclined belt conveyor, feeding to bifurcated spouts, considerable time and labor expense is saved in the loading of coke, both to gondola and box cars. The tracking arrangement under the spouts is of importance.

Figure 13 shows the loading of ice from pond directly to box cars for shipment to city storehouses or to railroad icehouses located elsewhere. Here speed of loading is an essential, and it will be noted that the engine is already coupled to the train, and that several cars are being loaded at once. The conveying equipment consists of simple drag chain conveyors, which pull the ice over slat runways.

When bulk materials are received in box cars, they present a difficult problem of unloading. To be the man operating a power shovel when unloading lime, as shown in figure 14, is not the most pleasant job, but the power shovel permits quicker unloading and causes less dust than would be the case if several men were shovelling with scoops at one time. It also speeds up the operation, thus making the time required for a man to be in this nauseating atmosphere shorter. The power shovel shown handles the material to the car doorway where it is dumped directly into the bucket elevator and raised to overhead storage tanks.

Smaller materials of this nature are being handled by means of pneumatic conveying systems, and it is hoped that as the development of these systems increases, it will be possible to handle large lump materials as rapidly and efficiently as they now handle the finer materials.

While several pieces of equipment have been shown for the direct operation of unloading, we wish to call attention to the power driven car puller, shown in figure 15. Power car pullers are of great assistance for shifting loaded or empty cars over track hoppers or to building doorways, etc., facilitating quick shifts at any time during the day, and not making them contingent upon the regular daily visit of the yard engine, as is the case in many instances. Moreover, figure 15 shows an elaborate conveying system and spouts for the handling of assorted coals.

Simple riggings are frequently large money savers as was the case of this car unloading equipment for handling road building materials. On such jobs, it is necessary to unload steadily so as to always have material in the small storage hopper to feed the trucks without delay.

This device in one day unloaded five carloads of materials with a total of 459½ tons. The job was accomplished in ten hours, which would make an average speed in handling of about 46 tons per hour, although one car containing 61.2 tons was unloaded in 43 minutes, which would be at the rate of 85.2 tons per hour. The labor costs of handling this material (gravel) was $8.00, or less than 2¢ per ton, to say nothing of the time saved by automatically loading the trucks.

Similar equipment is designed for handling coal in industrial plants. The bucket is self-dumping and is shown open, on the return run to the pit beneath the tracks for reloading.

To show the difference in the use of materials handling equipment in car unloading or loading, we direct attention to figures 19, 20 and 21, which show from a simple to a very elaborate method of unloading pig iron or metal. If the yard is small and tonnage handled is at the rate of

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about one car per day, a conical gravity conveyor as shown in figure 19 will greatly assist in the unloading of pig iron. If, however, there is other work about the plant yard of a miscellaneous nature as shown in figure 20, it would be advisable to install a boom crane equipped with magnet and operating on a tractor, so that it can travel about the yard without the necessity of running over definite lines of tracks. This sort of equipment when fitted with grab buckets and slings, can also be used for unloading heaving machinery, coal, etc. In the case of handling large sheet metal, I-beams and other shapes, scrap metal, pig iron, etc., the crane with double trolley operating on an overhead superstructure, and equipped with a magnet, hook, and slings will be found a great saver in time and labor on the unloading of cars and the distributing of the material to proper stock piles.

These illustrations may be said to go from the ridiculous to the sublime.

Locomotive cranes, as shown in figure 22, are common sights in the coal storage yards of large industrial plants. They have for years been the main medium for the loading and unloading of cars of bulk materials, such as coal, ore, stone, etc. Nothing need be said about the efficiency of this type of equipment, as it has been so long demonstrating its own value.

Some plants, because of their restricted space, are confronted with the problem of unloading coal from cars, and where it is impossible to install either a conveyor system or use the regular type of locomotive crane. The same is true on the handling of ashes. The cab-operated monorail telpher system, with grab bucket, as shown in figure 23, is operating under such conditions, and has been found very efficient as a car loading and unloading device.

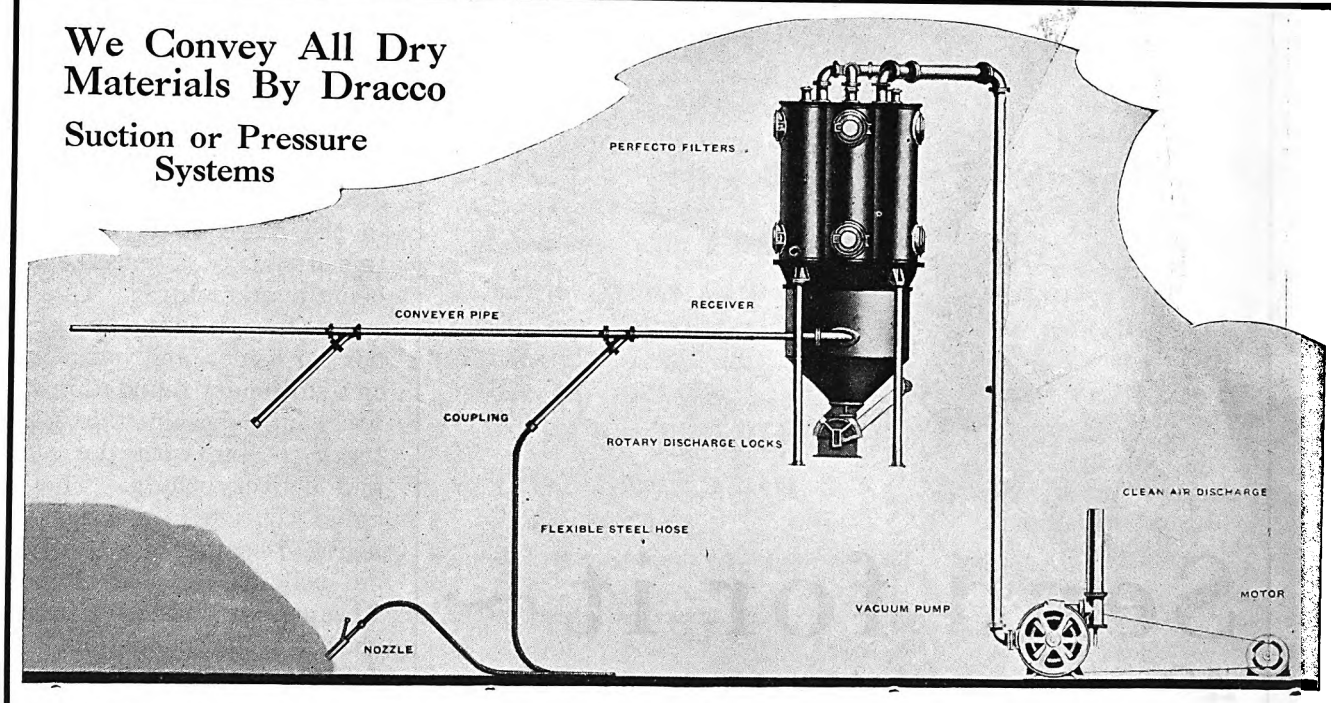
The illustrations shown so far cover the general run of small plant car loaders and unloaders, but large industrial plants and enterprises are confronted with what is known as large tonnage loading and unloading. These plants also require many cars each day. It is therefore more than essential that all cars be loaded and unloaded as quickly as possible.

One of the first demands for a large tonnage car loading device was in the coal fields for the loading of coal to box cars. One of the first loaders developed for this industry was the work of a man named Ramsay, who invented and manufactured such equipment during the years of 1890-1895. This loader consisted of a rocking arm or ram suspended in the center doorway of a box car. The coal was delivered by a gravity chute to the doorway and falling against this rocking arm was thrown from the center out toward the end of the car. It was fairly successful, as far as the reducing of hand labor necessary for the loading of cars was concerned, but the operation pounded and broke the coal so badly that the number of installations was limited.

About 1895 a Mr. H. Phillips and W. E. Hunt independently conceived the idea of developing a machine primarily for the loading of coal in box cars, which machine would take the coal from the chute at the center doorway of the car, and delivered the same back into the end without the breaking and crushing which was so detrimental to the

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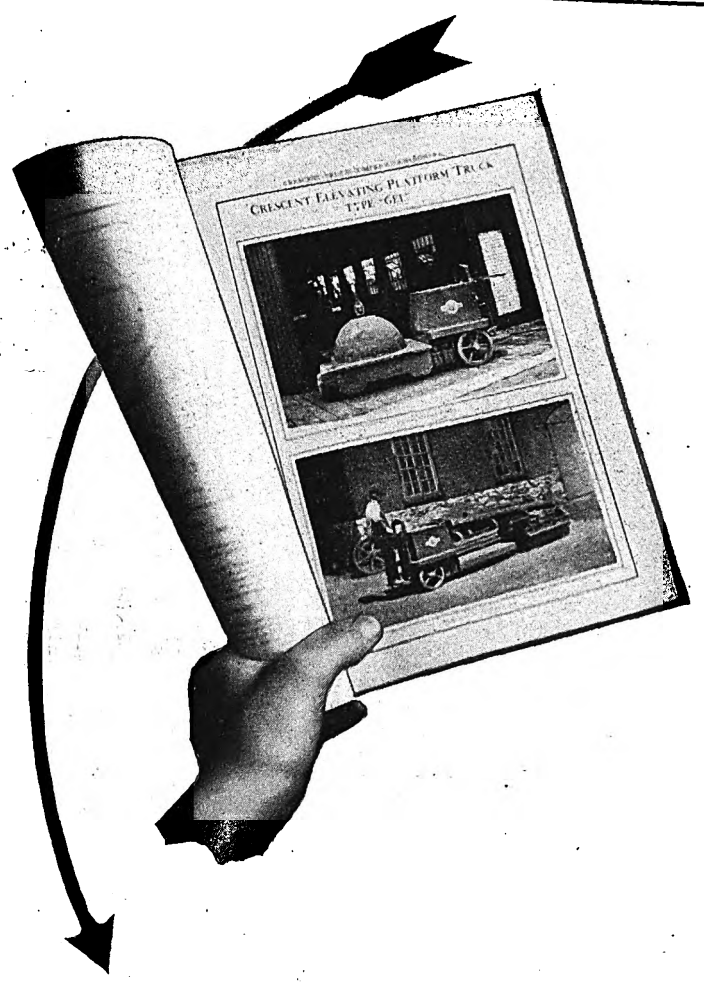
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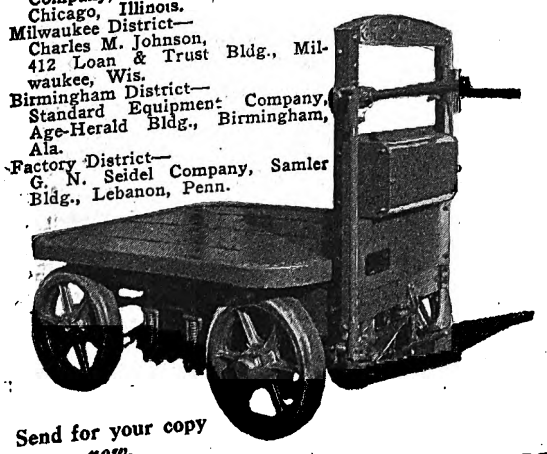
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sale of coal. These men soon learned of each other's efforts, and combining their ideas, manufactured the first car loader that was ever offered to the coal trade for the loading of coal into box cars, where consideration was given to the material handling. This first loader was installed at one of the coal mines in Iowa, and, needless to say, it was only a partial success, as there were many mechanical details that needed correction.

It was, however, of a general design that was developed rapidly, and the two first successful machines were installed a year or so prior to 1900, one in the State of West Virginia, and one in the State of Wyoming, and this same type of machine is still being manufactured. This loader was known as the pusher type box car loader, and was mounted on a stationary foundation which was built beside the loading track in line with the screens and delivery chute. This machine consisted in brief of a heavy I-beam frame, mounted on rollers attached to other I-beams, which are in turn anchored to the foundation.

Since that time, however, it has been necessary to make this equipment of a portable nature, and this is the type of loader shown in figures 24 and 25. Figure 24 shows a portable loader inserted within the car and handling lump sulphur, while figure 25 shows the same style of portable machine withdrawn from the car and a clear view of the working mechanism, which operates to place the material at the extreme ends of the box car. On the end of the frame, nearest the car, is located a heavy circular steel casting operating on large ball bearings, which permits it to be easily turned. In this circular steel casting is mounted a hopper, which is the real loading device.

This hopper is trough shaped and curved from end to end, in order that the end of the hopper in the center of the car is low enough to be under the chute and the other end of the hopper, which extends out into the end of the car, should be high enough to load the cars to capacity. Inside this hopper is what is styled a pusher, which, when the hopper has been filled with material, travels through the hopper, pushing the materials to the end of the car. A very ingenious ball and socket connection carries the power from the main power shaft of the engine or motor, as the case may be, to the hopper, permitting the hopper and pusher to operate at any angle to which the hopper may be turned.

When being placed in operation from its position at rest outside the car, the framework at right angles to the tracks, upon which the hopper is mounted, moves forward. The hopper is turned at an angle at the start, and as the main frame continues its forward movement, the hopper is swung around parallel to the length of the car. As the dumping of the material commences, the entire hopper travels forward toward one end of the car. In this way the hopper is entirely filled with material and the pusher comes into action with the hopper held stationary. The pusher travels out toward the end carrying the material ahead of it, and in to the end of the car. When the pusher reaches the end of the car it automatically trips the hopper, which then again travels past the chute being filled with material, and the pusher again deposits this material in the opposite end of the car. Thus practically continuous movement of the hopper and the pusher, from one end of the car to the other, alternately depositing at each end, takes place, the loading continues without interruption until the car has been loaded, at which time the loader can be quickly removed from the car, reversely as described for entering. If desired, the doorway of the car can then be filled up by dumping direct from the feeding chute.

A different type of car loader on the same principles, but using a belt conveyor instead of the traveling hopper, is shown in figure 26. When unloading cars the problem is somewhat different, and figure 27 shows a rotary car dumper, which is capable of handling one loaded car at a time. This dumper rotates, spilling the contents of the car directly to hoppers beneath the tracks. The empty car is then removed and another full one put in its place. This type of equipment is now being used extensively in large public service plants.

Figures 28 and 29 illustrate, respectively, the end tip and the side tip of a car unloader. It is possible with this machine to unload a car in about five minutes time. It is especially useful at grain elevators, in fact, in the unloading of any bulk material

(*Continued on page* 35)

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How much money would *your* plant save if one man hauled 16 loads at a time?

Great long caravans of heavily loaded Stuebing trucks may be seen almost any time of day in the prominent plant where this view was taken.

If it were more economical to do the job any other way, or with any other trucks, Stuebings, in trailer formation, would not be used, for there is no sentiment in profit-making!

There are hundreds of plants in which this same system can be used with equal economy, efficiency and all-round satisfaction.

Think, for instance, of *your* conditions. Are you trying to achieve results with trucks *other* than Stuebings in the face of an almost universal preference for Stuebings among the nation's greatest industries?

Almost every present user of Stuebing Lift Trucks "graduated," just as you will, after a period of experiments and costly experience.

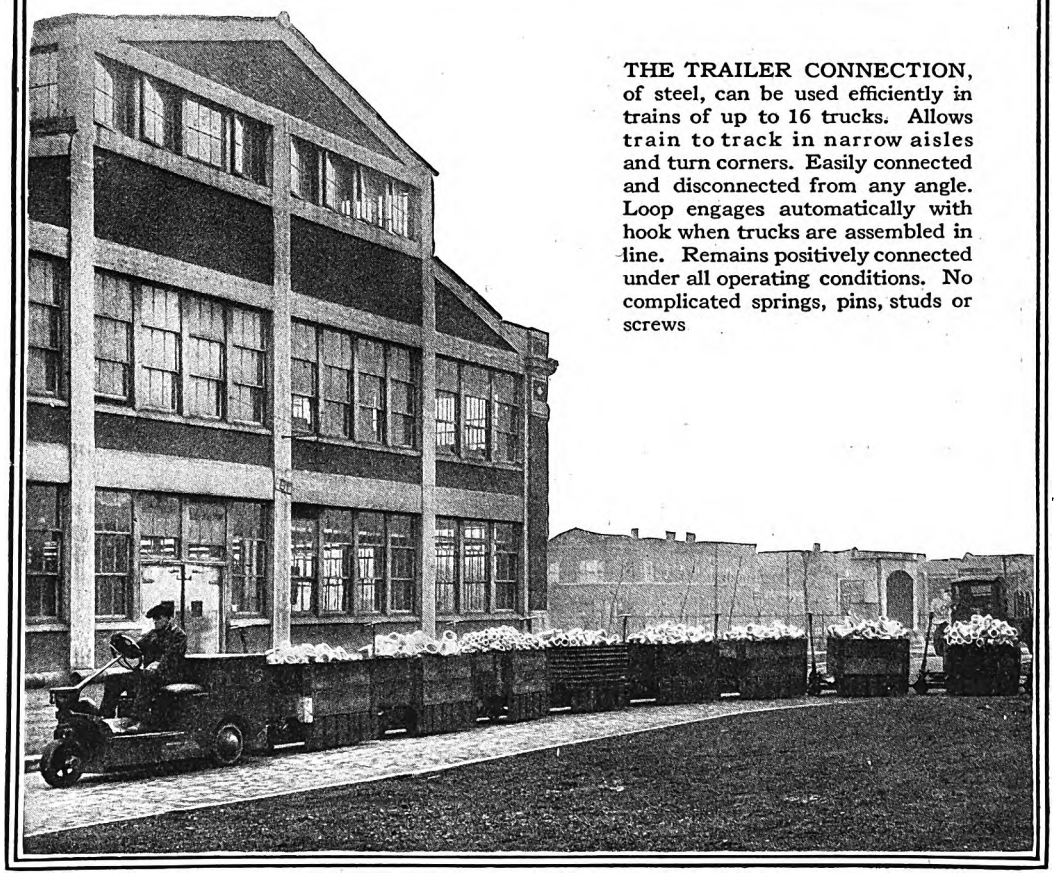
Are you figuring your hauling costs on a one-man-per-load basis? Then, look again at the view below. If you can use the lift truck trailer system picture what it would save *you* in labor costs.

And, in addition to the saving of labor in *hauling*, you can include the very tangible profit gained from the saving of labor in *handling*, for Stuebings *eliminate the re-handling* of every load they haul.

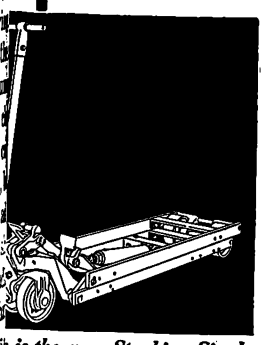
You can figure these savings in dollars and cents when the efficiency and economy of the Stuebing System is *definitely applied to your own material handling problems.*

Let us arrange with a Stuebing representative to do this. He will lay before you the facts and figures which will quickly enable you to determine how profitably you can use Stuebing Lift Trucks. Write us today for a copy of our new 36-page catalog.

THE STUEBING TRUCK COMPANY
Cincinnati, Ohio — Cornwall, Ontario
Branch Sales Offices in all Principal Cities



THE TRAILER CONNECTION, of steel, can be used efficiently in trains of up to 16 trucks. Allows train to track in narrow aisles and turn corners. Easily connected and disconnected from any angle. Loop engages automatically with hook when trucks are assembled in line. Remains positively connected under all operating conditions. No complicated springs, pins, studs or screws



is the new Stuebing Single Lift—a revelation in lift-ease, in convenience and in ty of operation and economy ervice. . . . There are Stue- Lift Trucks of every kind size to meet every interior ling need

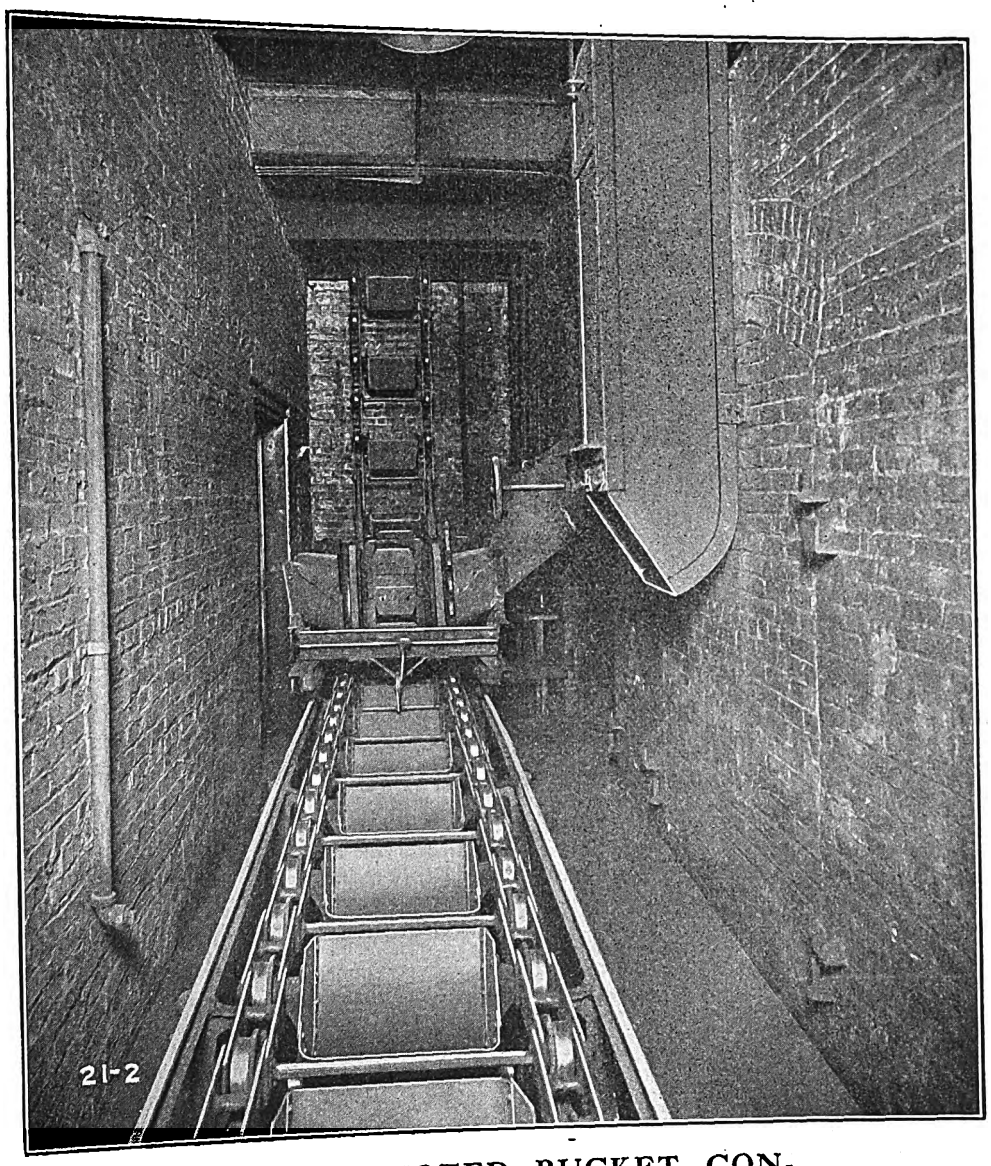
StueBing
LIFT TRUCK SYSTEMS

© 1924, T. S. T. Co.

NO OTHER LIFT TRUCK IS BUILT LIKE A STUEBING!

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10,000 Acres of Coal Land For One Ear of Corn Yearly



HUNT PIVOTED BUCKET CONVEYOR SHOWING MOVABLE FILLER

The buckets are loaded by a filler of the revolving drum type, which is driven from the conveyor chain through a wheel designed to properly engage in the links of the chain. The filler moves in perfect synchronism with the conveyor and gives an equal charge to each bucket, filling each bucket to capacity without spilling the material over the edges or between the buckets. It furthermore prevents dust and grit from getting into the working parts of the conveyor.

The filler can be set up at any point of the run where it is desired to fill the buckets; can be moved from place to place as necessary.

One hundred and six years ago, Josiah White, who operated a small rolling mill for the manufacture of wire and nails, at Schuylkill Falls, near Philadelphia, penetrated the wilderness around Summit Hill, Mauch Chunk, Penna., to examine the coal deposits existing there.

Quoting from an article by Henry M. Propper, —in a recent number of the New York Tribune Magazine,—Mr. White in his diary relates:—

> "—We at once set about to get a lease of 20 years on the Lehigh Mine Co.'s Coal Lands of 10,000 acres *for one ear of corn a year, if demanded.—"*

Nevertheless, Mr. White and his partner, Erskine Hazard, had innumerable difficulties in disposing of their "rocks that burn," (in the year 1817) at $8.40 a gross ton. People refused to buy at any price.

The greatest difficulty encountered was transportation from mine to market, since there were no roads through the almost impenetrable wilderness, and the rock-strewn shallows of the Lehigh River proved almost as insurmountable a barrier. However, they finally succeeded and laid the foundation of a great industry.

As in the early days mentioned in the foregoing, the transportation of coal to the consumer has borne the brunt of the expense and, prior to the past half century, the method of its distribution from the time of its receipt at the plant had also been fraught with many difficulties, was time consuming, laborious and expensive.

Then, in 1872, C. W. Hunt devised and built machinery which revolutionized the handling and rehandling of coal and ashes. Formerly, where muscle and brawn performed this task, Hunt Cost-Cutting Equipment took over the burden and made light work of it; made it less costly, made its action speedier.

For over half a century, Hunt Cost-Cutting Equipment has been helping each industry to produce profitably by reducing the coal and ashes and bulk materials handling expense; and Hunt Engineers have given of their best in planning a system to carry out to a satisfactory conclusion, the ideas engendered by 52 years' experience in their specialized field of materials handling. Call on them for assistance at any time; the sooner the better for you.

C. W. HUNT CO., Inc.

West New Brighton, New York City

Phillips, Lang & Co., Inc.
431 South Dearborn Street, Chicago, Ill.

New York Office—Whitehall Building

Ernest F. Learned,
141 Milk Street, Boston 9, Mass.

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(Continued from page 32)

where a large number of cars per day must be unloaded.

The car to be unloaded is run on to the tipping cradle when it is in a horizontal position, gripping devices are then mechanically raised, which catch, center, and hold the car rigidly in position, and a chute is moved against the car and car door openers take hold of the door. The operator starts the motor, which tilts the deck and tips the car to the side to an angle of from 15 to 24 degrees. As the car tips to the side, the grain door or boards are removed, permitting an opening under the same through which the material to be unloaded can flow. At the same time, the operator starts another motor, which tips the cradle to one end, and the material in the center of the car immediately flows out through the unloader chute and down into a hopper to some type of conveying system, and as the tipping continues, the material at the high end of the car flows out entirely. It can readily be seen that the end tip gives the material the momentum, and the side tip directs the flow so that it is carried to the side door through which it flows.

The first end is quickly unloaded, the cradle is then returned to the horizontal and tipped to the opposite end. This unloads practically all the material in the second tip, except a small portion, which will have run past the car door and the third tip entirely removes this last material.

The cradle and the tilting deck are then returned to the horizontal, the supporting posts swung under the cradle ends, the chute and the car door openers removed, the grip released from the car and the car removed, giving place to another loaded car. A full grain car can be unloaded in from five to nine minutes time, depending on the facilities of getting the cars to the unloader and removing the empties therefrom.

It is not only industrial plants that are giving thought to the unloading of cars, but the railroads themselves are locating cranes as shown in figure 30 at most of their freight terminals to assist in unloading heavy equipment direct from cars to consignees' motor trucks, wagons, etc.

If everyone will coöperate in the unloading and loading of cars at all times, it will do much to eliminate the hue and cry of car shortages.

In addition, loaders and unloaders have many advantages:

They reduce labor expense and permit men to be released for more productive labor. Many men are now required to unload box cars at large elevators, terminals and transfer plants, etc., which could be just as well taken care of by mechanical devices.

They save track unloading space, buildings and equipment. In order to unload many cars per day, it is necessary to have a number of unloading pits, also a great amount of tools and equipment. This requires an expensive track arrangement, and expensive buildings to cover these loading pits. Mechanical loaders operate over one pit on one track and with very small building for covering. A considerable initial investment, large maintenance expense and valuable space can thus be saved.

They permit continuous operation. This is made possible by the installation of mechanical loaders and unloaders and the plant executive is no longer de-

The Turn of the Tide in Motor Hauling!

Demands of Economy, Efficiency and Time-Saving Have Forced Tractor-Trailer Method to the Front

The Year 1923 More Than Doubled the Number of Users of

LAPEER SEMI-TRAILERS

It has been demonstrated that one tractor and three Lapeer Semi-Trailers can do the same amount of work performed by three motor trucks, within the same length of time, at ONE-THIRD THE COST OF OPERATION and with ONE-HALF THE INVESTMENT in equipment.

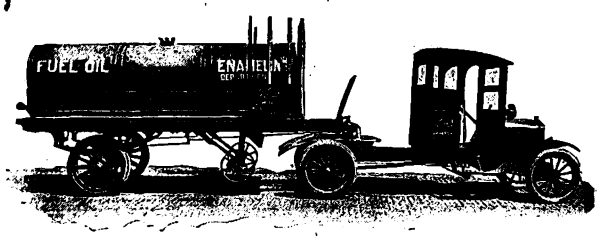
Motor Capacity Trebled

Ton-Mile Cost Cut to One-Third

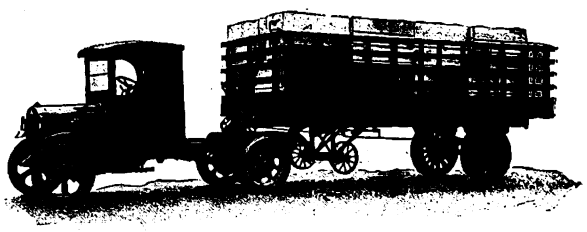


No Idle Motor During Loading and Unloading

One-Half the Investment



Any Kind of Body — Any Kind of Hauling



A STEP BEYOND THE TRUCK

Here Are the Distinctive Lapeer Features:

COUPLING—The Lapeer Semi-Trailer is coupled or uncoupled automatically and instantaneously, without the use of jacks or other devices, the operation being controlled by the tractor chauffeur from his cab without leaving his seat.

BRAKING—The brakes upon the trailer apply automatically when the trailer is uncoupled, making it unnecessary to block the wheels. The brakes are automatically released by the coupling operation. The trailer brakes also apply automatically, when descending a grade, to prevent the trailer from over-riding the tractor.

CONTROL—The tractor driver has complete and accurate control of the trailer, both forward and in reverse.

MOBILITY—The Lapeer Semi-Trailer, when detached, is a complete vehicle, the front support wheels enabling easy moving about by hand or otherwise.

Manufactured by

LAPEER TRAILER CORPORATION

LAPEER, MICHIGAN

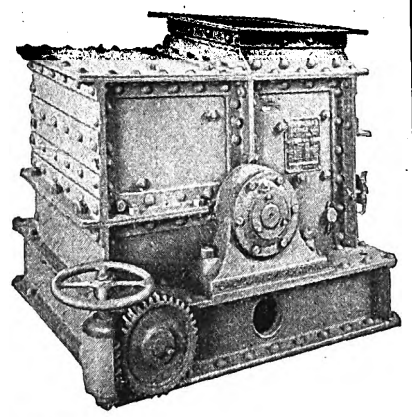
BRANCHES: NEW YORK—PHILABELPHIA—BOSTON

DEALERS: CLEVELAND—DETROIT—CHICAGO—ST. LOUIS—BUFFALO—LOS ANGELES—NEW ORLEANS

Write for Lapeer Folder I-101 and list of Lapeer users.

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PENNSYLVANIA

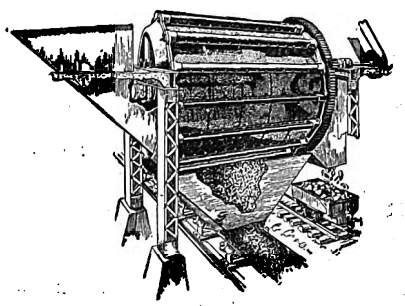


HAMMER CRUSHERS

39 Sizes

For Coal, Lime, Limestone, Shale, etc.

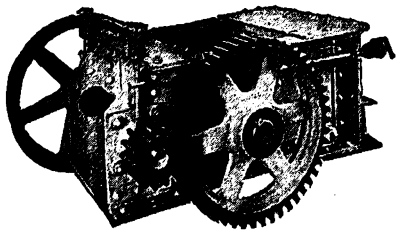
(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
(c) Oversize Bearings
(d) Patented Tramp Iron Separator
(e) Manganese Steel Wear Parts



BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY

Stephen Girard Bldg., Philadelphia.
New York Pittsburgh Chicago

pendent upon unreliable labor.

They release cars and save demurrage. At every plant delays have many times been made by failing to load or unload within the allotted free time. This results in serious handicap to railroad management, to the public who needs the cars, and is a direct financial loss through the payment of demurrage to the owners of the plant.

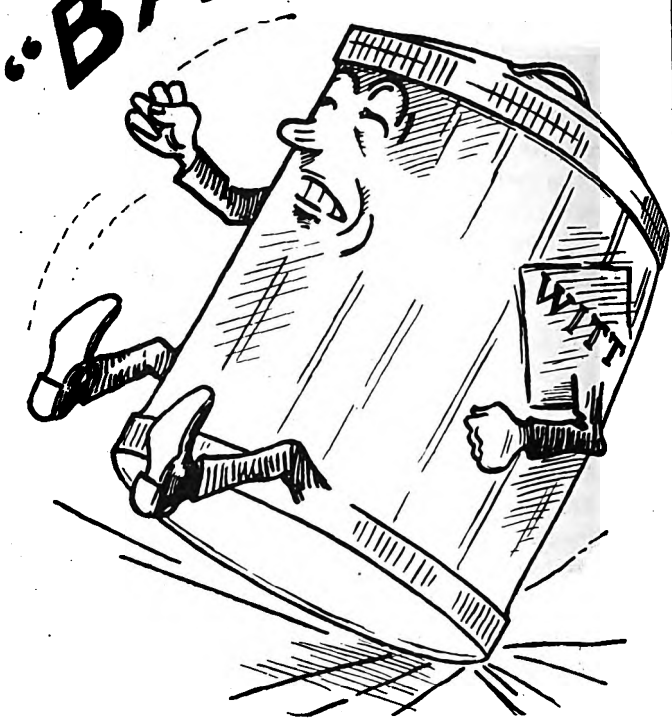
They simplify conveyor systems. With a multiplicity of unloading pits, a complicated conveyor system would be necessary. Such systems are extremely expensive, and cost money to maintain and operate. They also require considerable room. Why not eliminate these many pits, complicated conveying systems and unload into one pit and on to one conveyor.

There are many other advantages too numerous to mention, but which have undoubtedly presented themselves to the readers. Many plants have heeded the advice of these pages, and have installed conveying systems, lift truck methods and monorails and telphers, for handling materials within the plants, and they should therefore direct attention to the loading and unloading of cars, so that there will not be a choke point in the receiving of raw materials and the shipping of finished products.

"In an advancing social order, power must be both cheap and plentiful. Therefore every possible economy must be practiced. This implies the conception of a state-wide (and ultimately a nation-wide) reservoir or pool of power into which we may pour energy from whatever source, and from which storage we may take out energy to meet widely diversified scattered needs.

"Giant power means cutting out waste. The burning of raw coal in power plants and on our railroads has come to be recognized as waste, involving as it does, the loss of by-products, such as ammonia, needed for fertilizer on the farm; tar for road-building, and other hydro-carbons useful as dyestuffs and otherwise in the industries. If these economies can be realized through building large scale by-product distillation and power plants at the mines, it will mean cheaper power because of the reduction in the cost of fuel."—*Governor Pinchot of Pennsylvania.*

"BANG!"



"Did you see the abuse that man handed me? Go to it, old boy, you may shake up my contents but you can't hurt me! I'm built for rough usage."

WITT CORRUGATED CANS AND PAILS

because of their remarkable durability, will insure efficiency and dependability in the handling of your oils, small parts, rubbish, etc. Their rugged construction—deeply corrugated sheet steel held firm and rigid by heavy iron bands at top and bottom—enables them to withstand unusual and severe service. Their water-tight seams and close fitting lids are protection against the fire hazard.

For oil-soaked rags and inflammable liquids, a special can—Witt Corrugated Oily-Waste Can—bears the label of approval of the Underwriters' Laboratories, Inc. The use of this can will reduce your insurance premium and more than pay for themselves.

If your mill supply house does not handle WITT Corrugated Cans and Pails, write us. There is a type and size for every purpose.



WITT CORRUGATED Substantial Sanitary Safe

The WITT CORNICE CO.
CINCINNATI, OHIO.

THE YELLOW LABEL MEANS QUALITY

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Making Steam Do Double Duty

(*Continued from page* 28)

needs only to have the lubricating oil extracted before it is again ready for introduction into the boilers.

Where high vacuum is essential, such as in steam turbine operation, the surface condenser is generally selected for the service, although the barometric condenser may also give excellent results.

The condensing engine or turbine can be used only where a sufficient quantity of suitable water is available at a reasonable cost. In some instances it may be necessary to utilize the same cooling water over and over again, in order to avoid excessive water bills. In such cases an outdoor reservoir or pond may be provided and suitable means installed for reducing the temperature of the hot circulating water as it comes from the condenser.

Where only a cooling pond is provided, the water may be cooled partly by the radiation and conduction of the heat from it, but the chief cooling agent is the evaporation of some of the water, by which action heat is absorbed from the balance of the water in the pond. Where engines operate only twelve hours a day, the pond should provide 105 square feet of surface water for every horsepower. The depth should be such as to give a tank capacity of 300 cubic feet per horsepower.

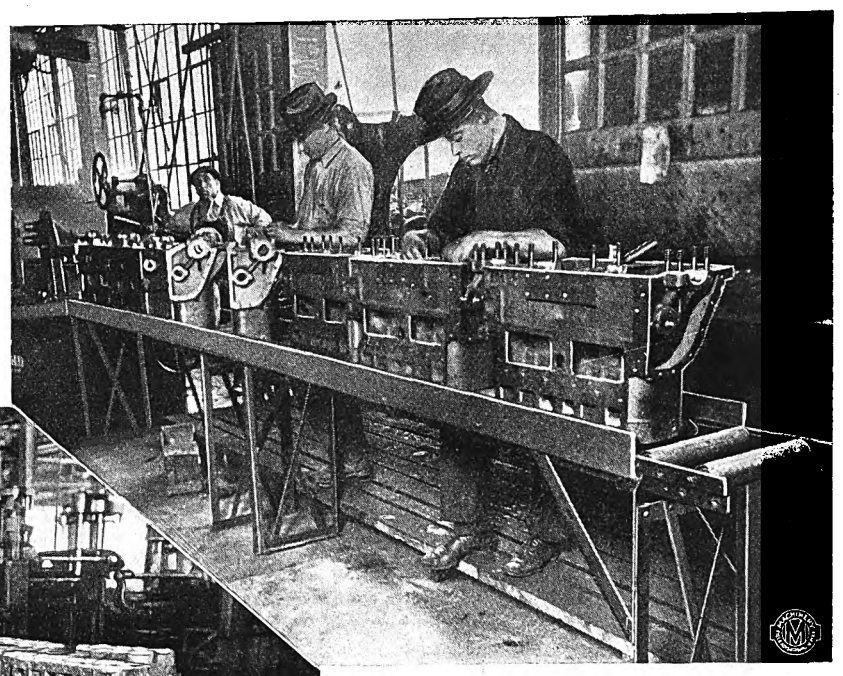
To hasten evaporation, thereby reducing the size of the pond required, the hot circulating water from the condenser may be distributed through a network of pipes to a multitude of spray nozzles, from which it falls to the pond in a spray.

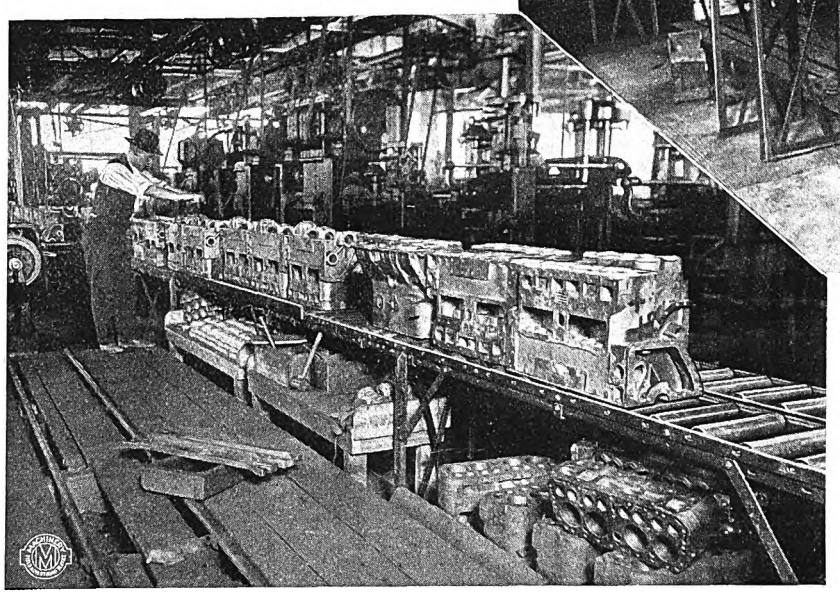
Where ground space is not available for the use of a spray pond, a cooling tower, consisting of a wooden or sheet iron housing, open at top and bottom, may be so arranged that the hot circulating water can be pumped to the top and distributed along the tower in such a manner that it falls in thin sheets or sprays into a receiving tank at the bottom. A current of air is drawn through the tower by natural draft, or forced through by suitable fan or blower. This air current cools the water by the evaporation principle and the heat absorbed from the water is carried out of the tower with the air.

With the best types of cooling towers the temperature of the cooling water may be reduced, under favorable conditions, from 40 to 50 degrees, with a loss of only 3 or 4 per cent. of the water passing through the tower. The power used by the fan is not more than 1 or 2 per cent. of the total power developed by the prime movers. Such a tower may be located on the top of the building and may be any reasonable distance from the condenser itself.

Where the heat in the exhaust steam from the engines or turbines can be entirely used for heating and industrial purposes, condensing operation would not be economical. If the prime movers were to be operated condensing under such conditions, it would be necessary to supply live steam from the boilers for the heating service; whereas, if

Handling Motors Without Power Cost===





Would It Save For You?

A FAMOUS automobile manufacturer moves crank cases through his machine shop by the cost-free force of gravity. His conveying cost is nil. A sugar refiner transports sugar from the warehouse to cars by gravity. His power cost is nothing.

A hundred manufacturers, large and small, move varied materials and products on Mathews Gravity Conveyers. So they eliminate truckers' wages, trucking congestion, confusion at elevators and similar, unnecessary costs.

In *your* plant these varied experiences may suggest a considerable saving. A 50 to 75% reduction would not be unusual. The labor saving advantage alone is worth an investigation.

Your products may be small or bulky. You may move them once or many times in your plant. Yet there is a Mathews Gravity Conveyer that will put the costless power of gravity at work on your material handling.

A Mathews Engineer will be glad to study your requirements with you, and point out any opportunities where savings in your transportation may be made. Or, if you wish, we will send the Mathews catalog showing many instances of cost reductions. Write us.

MATHEWS GRAVITY CARRIER CO.
157 Tenth Street **Ellwood City, Penn.**

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they were operated non-condensing, and the exhaust steam used for heating, the demand for live steam for industrial purposes could be greatly reduced, if not entirely eliminated, and a material saving could be effected.

In a large manufacturing plant in New England a 1,000 kilowatt turbine was recently installed to assist in carrying the plant load. Variations in power, exhaust steam and hot water requirements in the plants made necessary a careful study of the operating conditions, with a view to selecting the proper type of turbine to satisfy these requirements in the most economical manner.

An unusually economical arrangement was finally determined upon by the selection of a turbine that would operate as a straight condensing unit when the exhaust steam from other units was sufficient for the demands of the low pressure line. When there was a deficiency in this line, the turbine would operate non-condensing, delivering its steam to the low pressure steam main. If only a fraction of the turbine steam was required to make up this deficiency, sufficient steam could be bled from one of the intermediate stages to supply this demand, the balance of the steam passing through the low pressure end of the turbine into the condenser.

This turbine could also operate as a mixed flow turbine, receiving both high pressure and low pressure steam from the exhaust of the reciprocating engines, when there was a small surplus of steam in the low pressure main. If the surplus of low pressure steam was sufficient the turbine would operate as a straight low pressure turbine. In both these cases the exhaust of the turbine went to the condenser.

The change from one condition to another was made automatically in response to the pressure existing in the low pressure main.

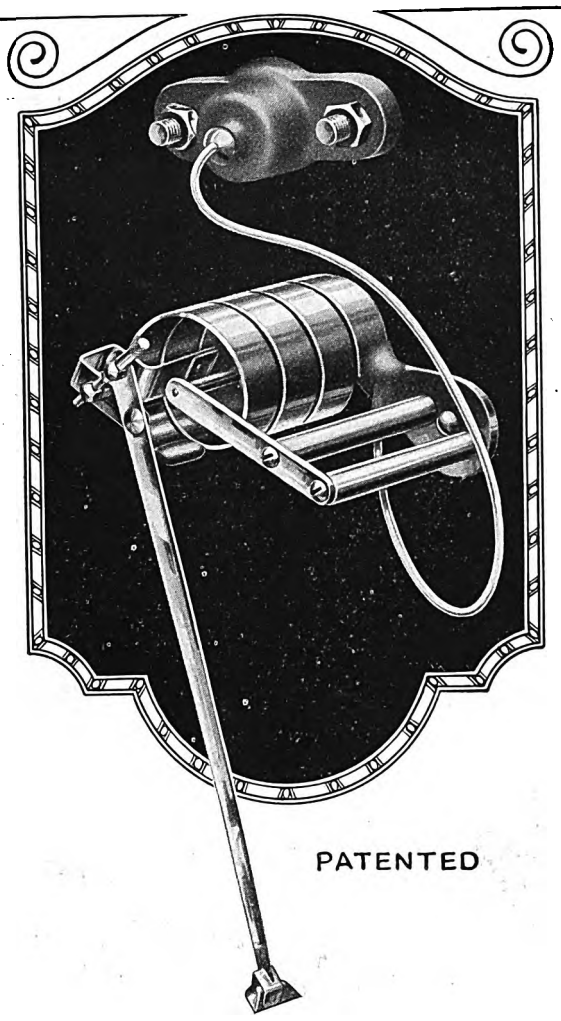
This splendid example of low pressure steam economy in connection with the condensing operation of steam engines and turbines is cited not because it is at all unusual, but because it is typical of what may be accomplished in the way of economy in the use of steam and in realizing all the usefulness available in exhaust steam, thereby attaining high operating economy and low power costs. Similar conditions are found in nearly every industrial plant and can be met in the same intelligent way.

The extent to which industrial life in Germany has been coordinated, it is stated, is shown by the fact that more than seven hundred German national standards have been adopted. This includes only those in which several different industries are concerned, and which are approved by the central national body. These include fundamental engineering standards as: standard diameters, tapers, sizes of keys, threads, fits, etc.; materials, tools, measuring instruments and gages; machine parts, including handles, ball and journal bearings, etc.; gears, and sizes of paper.

Not Exactly A Parlor Story

A recording instrument salesman wound up his long eulogy by exclaiming, "Look at the brains in that instrument."

The engineer, his prospect, replied, "Sure, it has brains. But the Foxboro Recorder has brains and *"guts."*



What this engineer meant was that the Foxboro Improved Helical Tube Movement is permanent in calibration.

It has strength. Not the clumsy strength of excess metal, but the sinuous strength of virgin ingot metal, drawn, shaped and tempered by a secret process discovered by Foxboro engineers 2½ years ago.

It can be used constantly at maximum chart range. No limited "working ranges" specified.

It positively will not fatigue, set, split, leak or crack even when subjected to excess pressures that carry the pen way beyond the outer edge of the chart.

The pen arm has a definite axis of rotation. Pens always follow time arcs of charts.

Accuracy within less than 1% of total scale reading is guaranteed. No adjustments are necessary.

The Foxboro Improved Helical Tube Movement frees you from the limitations of obsolete principles of recording instrument construction.

Write for Bulletin A154.

THE FOXBORO CO., INC.

Neponset Avenue, Foxboro, Mass., U. S. A.

New York Chicago Boston Philadelphia Pittsburgh Cleveland Rochester
Birmingham Tulsa Los Angeles San Francisco Portland, Ore.

Peacock Brothers, Limited, 179 Delorimier Avenue
Montreal, Canada

6072.

FOXBORO
REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY

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Can be operated with greater satisfaction

and uniformity of results by making your purchases of photo paper and chemicals direct from the manufacturer. By means of Rectigraph Photo Record Paper and chemicals, you can improve the quality of your work.

We are manufacturers, selling direct. You get the advantage of prompt service and high quality at a price which is right. Hundreds of satisfied customers sending us repeat orders indicate that our prices are right and that the material is "making good."

A trial will, we believe, convince you that you too can benefit by the use of Rectigraph Products.

Send us your order for a roll of Rectigraph Paper, spooled to fit your photo apparatus so you can judge of its merits.

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Originators of the Photo-Copy Machine

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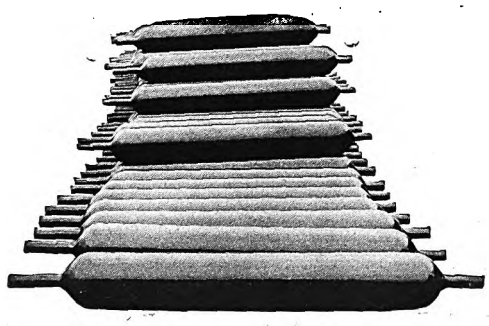
For the buying facts regarding

INDUSTRIAL and POWER PLANT MATERIALS and EQUIPMENT

See SWEET'S ENGINEERING CATALOGUE

TAYLOR-WHARTON IRON & STEEL CO.

TIOGA STEEL & IRON CO. | Wm WHARTON Jr. & CO. Inc. | PHILADELPHIA ROLL & MACHE

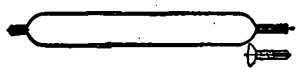


SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Whenever rollers are used, Conveying Systems, Steel Mill Tables and the like, maximum neck-strength is required because here the strain is most severe. Wharton rollers are made in one piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained.

Yet, because they are hollow they are light in weight—saving in freight—easy to handle—lower power cost. Built only on order to meet customers' requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large-sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.



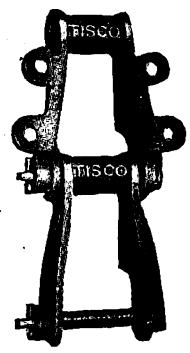
Cross-Section Showing Hollow Construction

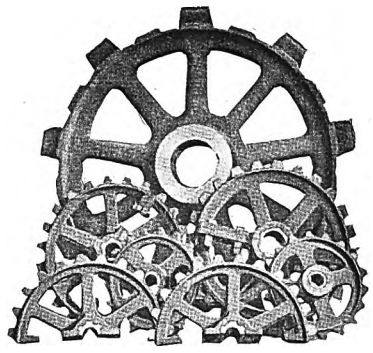
Wm. Wharton Jr. & Co., Inc.

(Founded 1859)

30 Church Street, New York, U. S. A.

Cable, Whilwharton, New York





TISCO Manganese Steel Chain and Sprockets

Recognized as the standard in manganese steel. Records of its performance show durability from five to fifteen times as long as malleable iron.

Bulletin 113-J embraces complete description of these products with illustrations of the various types.

Taylor-Wharton Iron & Steel Co.,

High Bridge, N. J.

Products of the Allied Companies—Catalogs on request.

Manganese Steel, Manganese Wearing Parts, Special Track Work, Cylinders for Gases, Hammered and Pressed Forgings, Rolls and Rolling Mill Machinery

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The Oxy-Acetylene Flame in Industry

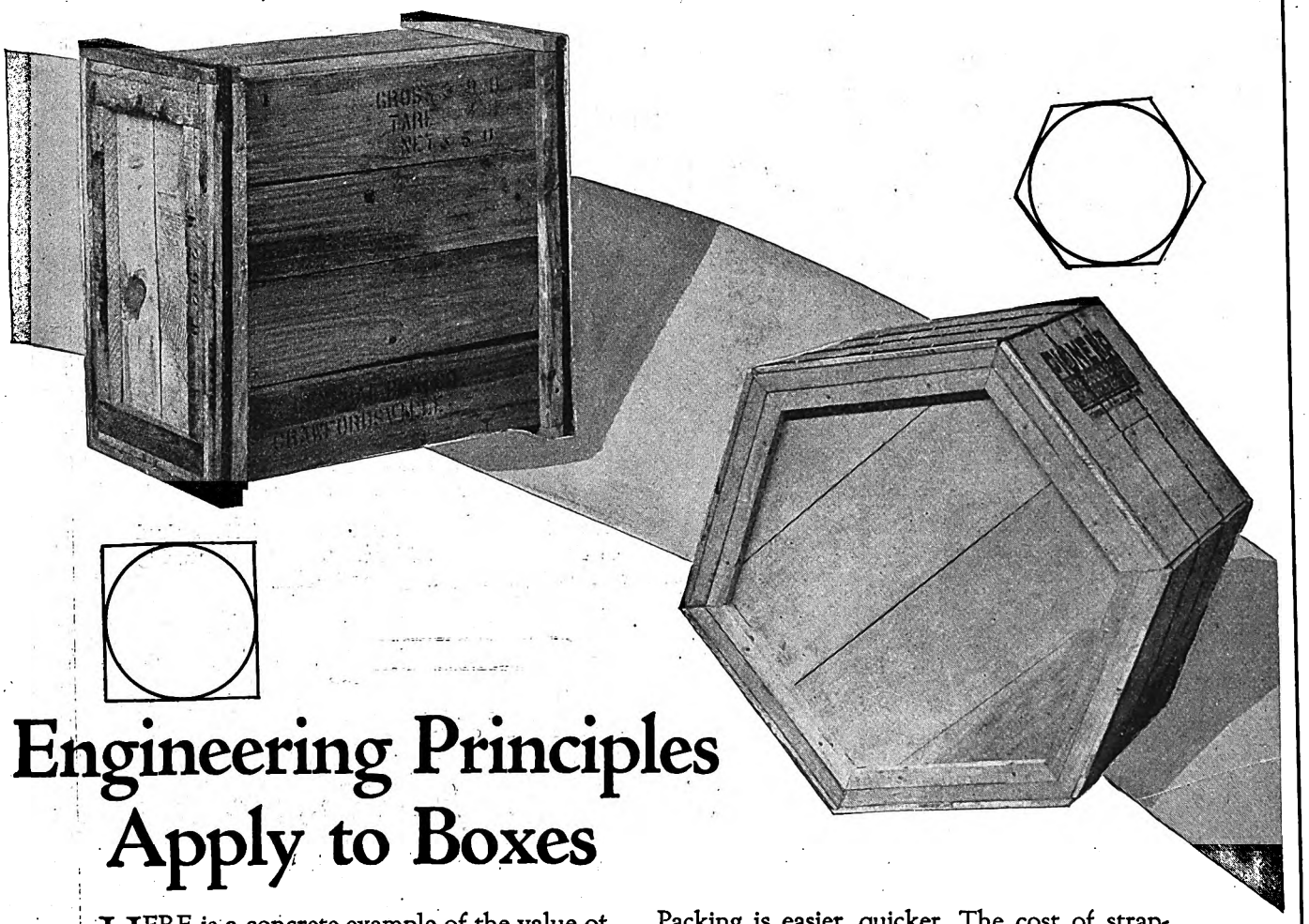
(*Continued from page* 25)

made to unite by the application of the hammer. The temperature is much below the melting point and the hammer, or an equivalent, is essential. In the processes of welding with gas, however, part, if not all, of the metal immediately involved is brought to the melting point, and the hammer may be dispensed with. This will become clear in what follows. Let us assume that it is desired to unite two one-inch steel plates edge to edge. The orthodox method requires that the edges be beveled at an angle of, say, 45°, and in such way that when edge is against edge, a 90° groove will be created. In order to secure a union, it is now proposed to heat up the sides of the groove to the melting point or nearly to it, and to fill in with new material, in a molten state, the entire groove. In fact, it is good practice to add more new material than is necessary to just fill the groove and so to create a rounded top. The workman holds his torch in the one hand and a rod, say, of Norway iron in the other. He begins at the bottom of the V-shaped groove, using the hot spot to soften the steel. When he has made a beginning of the closure and has a softened or melted surface of steel, he brings the end of the rod to the place. He seeks to add molten iron to molten or softened steel and thus secure a union of the two. He goes on in much the same way, adding molten iron to molten or softened steel until he has filled in the groove sufficiently for its entire length. The hammer is sometimes used; but it is hardly to be considered a necessary instrument when the heating and melting are properly carried out.

The result is clearly different from that produced by the old method of welding. We have here what is in fact a casting which has been formed in the groove. It consists of new metal. The procedure described is fairly typical. Nevertheless, there are many variations. Thus, it is not necessary that the V have a 90° angle. Sometimes, especially where the plates are thin, they are placed edge to edge without any beveling at all. It is, in fact, quite possible at times to unite plate to plate without the use of any new metal. The one edge is made to flow into the other.

The process may be used for purposes other than welding. The torch has been called a putting-on tool, because it may be utilized for the purpose of adding metal at some desired point. We can build up worn and broken cogs. We can add metal here, there and everywhere. We may in fact add a distinctly different metal. If an old casting has suffered the loss of parts, we may often build them up again. We use the hot spot to melt off metal from the rod and we thus get the new material in molten form. We also prepare the place where the added part is to go, and then add the new metal, thus forming a rough addition. Afterwards, the part can be machined or tooled to the precise shape wanted.

A little consideration will prepare us to perceive more or less clearly a field of usefulness in



Engineering Principles Apply to Boxes

HERE is a concrete example of the value of an unprejudiced Box Engineering Service.

On the left is shown the shipping box formerly used by a large metal manufacturer. The product is metal disks—circular in shape. This box is strong. Carries its contents safely. The steel bands give added strength and theft-protection.

The Pioneer Wirebound Box—shown on the right—was designed by a General Box Engineer. Note the shape and the consequent saving in displacement.

Equal strength and protection is obtained in the new box. The weight saved amounts to eighteen pounds per box. The product carries better because the Pioneer is designed to fit the shape of the product.

The cost of assembling is reduced. Twice as many Pioneers are assembled in the same time. Packing is easier, quicker. The cost of strapping is eliminated.

Enroute, the Pioneers save car space because they are nested in the car in honeycomb fashion. The destructive effects of shocks and strains are minimized. The Pioneers also handle easier—from the shipping room of the manufacturer to the receiving room of the customer.

Last, but not least, the customers highly approve of Pioneers. They are opened simply by cutting the wires—a matter of seconds. The top or sides are folded back, depending on the shape of the Pioneer. The contents are unpacked quickly without trouble.

If you would like to have a General Box Engineer design a box or crate to fit your product, just write us to that effect. This service costs you nothing—inconveniences you in no way.

A copy of "General Box Service"—an interesting booklet on better boxing and crating—will be sent to you on receipt of your request. Write for it today.

GENERAL BOX COMPANY

508 North Dearborn Street, Chicago, Illinois

SIXTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

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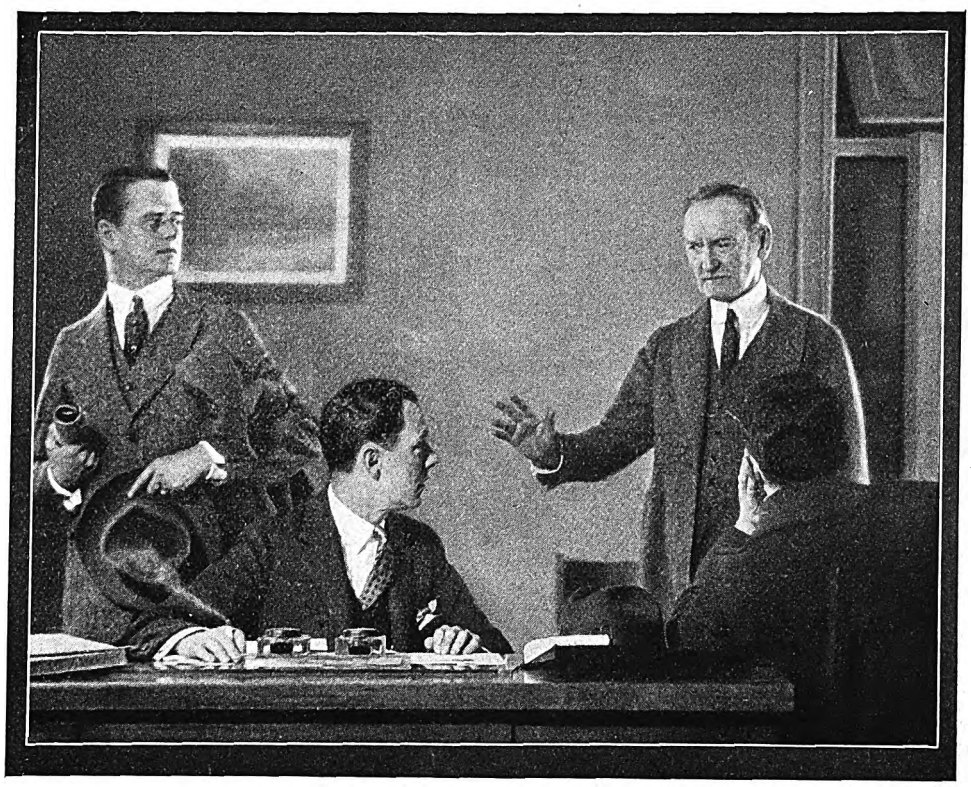
the foundry. Old and new castings may be dealt with in accordance with the requirements. Thus, a new casting may be found defective after it has come from the mold. It may be that it is only a small part that is missing—a lug or a boss or some other piece. Without it, the casting may be useless. By means of the oxy-acetylene process, the part may often be built up and the casting thus kept from the scrap pile. Or, if the part is of some size, it may seem preferable to cast it or otherwise form it and then attach it to the main casting by the welding process. Or, the form of a casting desired may be such that it can not very well be cast as a single piece. In some cases of this kind, the thing wanted may be cast separately and the two parts later on united by welding them together.

An old casting may have suffered the loss of a big or little part. By means of the oxy-acetylene process, we may often weld on a new part after it has been duly cast for us. Again, we may want a casting that is, when finished, a single unit, but which consists of parts of different metals. The process of welding by gas will often make such an idea a fact, because of the possibility of uniting piece to piece. I do not say that the problem can always be solved in the way indicated; but there are many cases where it can be done.

In the foundry, much trouble used to be experienced with blow holes. There is perhaps some trouble even today. But the situation must be greatly changed from what it was in the early years of the present century. Such holes may frequently be satisfactorily filled in with the aid of the oxy-acetylene torch and the welding rod. Great economies have followed in consequence of the utilization of the new procedure. For example, a large casting may be examined and found apparently sound. It is then put upon the planer and other machines in order to get it into final shape. Several hundreds of dollars' worth of machining may thus be done before some hidden blow holes are discovered. These may be of such a kind and so distributed as to make the whole affair useless. Here is where the filling-in process is indicated. The holes may often be satisfactorily filled and the casting machined to completion. The cost is absurdly low in comparison with the loss otherwise in contemplation. The remedy can not always be applied and the defects perfectly rectified. The filled-in places may be points of weakness. But, it will often happen that the reclamation of the casting will be quite satisfactory, nevertheless, because the weakened points will never be overstressed in operation.

The application of the oxy-acetylene process to the cutting off of risers and other necessary but unwanted parts of certain castings is one of great importance, especially in steel foundries. We will return to the cutting procedure later.

The oxy-acetylene process is admirably adapted to repair operations. This results largely from two facts: (1) The procedure is carried on by *localized heating*, and (2) the entire equipment may be used in *portable form*. The fact that the heating operations are confined to very limited regions makes it possible to deal with a great multitude of repair jobs without involving the whole part in the



Where the Facts Came From

In its essentials this dramatized story is just like the case of a large company in the Middle West where the Consulting Engineers, The George S. Rider Company, with the interests of their clients at heart asked to have the heating taken out of their contract if the clients put in a steam system instead of the Grinnell Forced Circulation Hot Water System they recommended.

The booklet, "Five Factors in Heating Costs," will be sent to anyone interested in heating industrial buildings. Send for your copy today. Address Grinnell Company, Inc., 307 W. Exchange St., Providence, R. I.

It went across with a bang and—bounced back

"IT'S all set, Charlie," cried the President's son as he ran down the office steps towards the young man who was waiting for him in the flashy runabout. "The old gentleman says it's up to me entirely on equipping the new plant."

Charles Wilson: "Fine—we'll show them some economies that will surprise them."

* * * * *

President's son: "Here's your office. So long. Bring your estimate up to the office by 2.30. I've got a date with that Consulting Engineer—Chadwick. He's been going over your plans which I gave him yesterday. Your price will just bowl him over. Told him his preliminary heating estimate was way out of line. Mighty glad I got you in on this, Charlie. Gives both of us a chance to put something across with a bang."

* * * * *

Consulting Engineer: "I have been over your friend Wilson's plans, and I must hold to my first recommendation. If you will sign —"

President's son: "Sign nothing. Wilson's system is $4,000 cheaper. I want that saving."

Consulting Engineer: "$4,000, is that all? I should have expected at least $6,000 difference. I can't approve."

President's son: "Well, I propose to put it across with a bang. I'll sign your contract, Charlie."

Consulting Engineer: "Then you will please take the heating out of my contract entirely. My reputation, young man, has been built on operating economy and not low first cost. And operating economy depends not only on the type of system but the ability of the contractor to interpret my plans."

President (stepping into conference from his private office): "Now that you've 'put it across,' as you say, I will have to bounce it back. I arranged it so I could hear through the transom. I gave you this chance so you might learn today what it took me 20 years to get into my head about building and operating plants. Now boy, get this. An able consulting engineer knows contractors from experience just as he knows materials and design from technical training. You must follow his advice just as you would that of a famous physician. His plans and specifications are his prescription Have it filled by the contractor he recommends just as you go to the high class pharmacist your physician designates to fill his carefully worked out formula.

"I've preached this same sermon before the National Manufacturers Association and many's the letter I've received from members who took my advice thanking me for the trouble and money I've saved them."

Consulting Engineer: "A few words will make my position clear to Mr. Wilson and your son. Mr. Wilson's cheaper steam system required a steam boiler plant in a factory that buys electric power. Such a system didn't take into account operating expense which every year would be some $1,500 higher than with the hot water system Grinnell Company laid out for me. If you will read their book, 'Five Factors in Heating Costs,' you will see other reasons for my recommendations."

President's son: "But why didn't you let my friend Wilson figure on a hot water system?"

Charles Wilson: "To be frank, Tom, industrial hot water systems are a specialized engineering study. Nobody can touch Grinnell on that sort of thing."

GRINNELL COMPANY

Automatic Sprinkler Systems | Steam & Hot Water Heating Equipment | Humidifying and Drying Equipment | Fittings, Hangers and Valves | Pipe Bending, Welding, etc. | Power and Process Piping

If it's Industrial Piping, take it up with us

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It Saves Cost of Installation

No Platform, Pit or Supports Needed

To install ordinary steam traps you have to dig a pit or build a platform or supports. All this expense is eliminated with the Sarco. For it is so small and compact that it screws right into the pipe line at any angle.

The Sarco requires little more space than an elbow. Consequently, it can be placed at steam-wasting points where the bulkiness of old-style traps would prevent their use.

STEAM TRAP

SARCO

saves money in many ways. Costs only one-third as much as most traps that do no more; if as much.

Having but one moving part, or about one-eighth as many parts as most traps, there are fewer parts to get out of order and require replacement.

The Sarco drains condensate as soon as it forms and returns it to the hot well while still hot. As a result, less coal is required to convert it back into steam. And it is so positive in action that not an ounce of live steam is wasted.

Why not try a Sarco for 30 days without cost and let it sell itself?

You'll be interested in reading our Booklet R-39. Write for it.

SARCO CO., INC.

236 Broadway, New York

Boston Buffalo Chicago
Cleveland Detroit
Philadelphia
Peacock Bros., Ltd., Montreal

operations. For example, the frame or bed of a big piece of machinery may have cracked. It is frequently, perhaps generally, possible to effect the repair without heating the entire frame or bed. In fact, it will be often unnecessary to remove the frame or bed from the machine to which it is secured. That is to say, we may not have to do more than heat the region of the crack. Of course, the torch must be continually supplied with the two gases, so that it is necessary to provide supply tubes and to have working room to accommodate them. And, the workman must, naturally, be given room enough to get at the job. The feed tubes may be flexible and there is no great amount of space necessary for the operator. Consequently, very many jobs indeed may be satisfactorily done without dismantling the piece of machinery. The second fact, which relates to portability, makes it possible not only to avoid dismantling, but to carry on the operations wherever the big piece of machinery happens to be. It may, for example, be a case of a break in the frame or working parts of a big grain thresher. The machine may consequently be back in the country. Even so, it is possible to take everything necessary to the spot. The oxygen may be carried in a portable tank; so also with respect to the acetylene. These tanks may be transported by wagon or motor truck. The weights will total no more than a few hundred pounds. Portable supplies of oxygen and acetylene may also be conveniently moved about in a works, together with flexible tubing, etc. In this way, the welding operations may be carried on, now in this spot, now in that.

The process of using gas for welding purposes has been extended to cases where what is sought is not so much a welding together of two plates, for the purpose of making one single plate that is everywhere uniform, as a *sealing* of a seam or crevice against the passage of liquid or gaseous matter. For example, the roof plates of a steel passenger coach may be sufficiently secured by the rivets which unite the edges to the flanges of T-bars spanning the car transversely. But the seams may be sadly lacking in respect to the prevention of the entrance of rain water. The oxy-acety-

(*Continued on page 46*)



MEDART
Steel Shelving

for FACTORIES
WAREHOUSES
STOCKROOMS
SALESROOMS

MEDART STEEL SHELVING is the "filing cabinet of the factory." Simplicity—flexibility—strength—durability—economy, are some of its features which have gained for it the patronage of experienced buyers. Send for a copy of catalog S-7, giving complete details.



MEDART
Steel Lockers

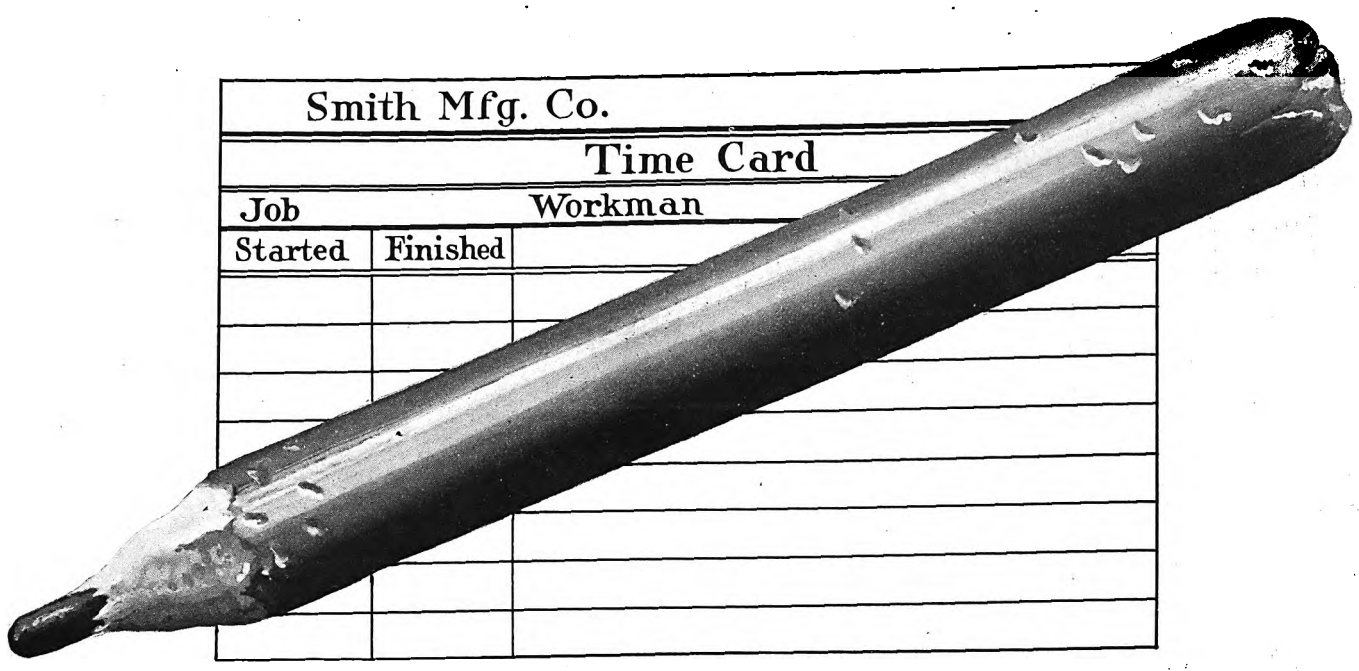
Medart Steel Lockers are furnished in all types and sizes to meet any need or arrangement. Write for catalog A-13.

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STEEL—the Symbol of STRENGTH

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Don't let this pencil stub waste your money in 1924

It is foolish to go through another year requiring your operators to keep their time on each job. They are poor time keepers at best.

Their interests are centered in other matters. When a job is finished they guess at the time which it took. Those guesses go to form the basis of your cost data. And it is a ten to one bet that your cost records are inaccurate.

Install a machine that records the *elapsed time* by a simple pull on a lever and save this money that you are wasting today.

The Calculagraph is a spring-driven machine free from the wiring troubles of electrical time recorders. It stamps the starting, stopping and *elapsed time* right on the job ticket.



It eliminates all errors on the part of the operator. He no longer guesses. The printed record is there as proof.

It saves the time of cost clerks. They no longer need to subtract starting from stopping time. The *elapsed time* can be read direct from the job ticket.

Any number of workmen can use one Calculagraph. A backward-forward movement of the right hand lever when the job starts, a pull of the left hand lever when the job is done, and the time record is complete.

Send for our booklet "Elapsed Time Records" today. It will interest you.

THE CALCULAGRAPH

THE ELAPSED TIME RECORDER

34 Church Street **New York City**

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Herein the Cowan Truck Company Presents th

If you study your cost figures and separate the time required for machine operations as against balance of time charged to the cost of that job, you will call for an accounting. The accounting will bring out this fact; time spent getting materials to and from operations, storage areas, etc. Analyze these statements and you will find Man-handling after Man-handling that *could* and *should be cut out*. It is at this point that the proper application of skid platforms and lift trucks will save you outgoing payroll money.

Increased production in itself does not reduce costs, but merely gives an inspiration which spurs the Management on to investigate labor saving devices. Many people today have reached the point

COWAN TRUCK COMPANY

HAND AND ELECTRIC LIFT TRUCKS
INDUSTRIAL TRUCKS AND TRACTORS

GENERAL OFFICE AND WORKS, HOLYOKE, MASS.

TO MEN CONNECTED WITH MANUFACTURING - WAREHOUSING - SHIPPING

The Cowan Truck Company as manufacturers of hand and electric lift trucks has, through its Engineers and the cooperation of its customers, designed lifting machines (or lift trucks), which give the greatest flexibility of application and; therefore, the greatest amount of payroll saving.

All equipment is Guaranteed as to Materials and Workmanship; parts are Interchangeable and Accessible. Features such as Ease of operation, Convenient and Effective Oiling System, Accessibility, Long Life, and Adaptability to both Light and Excessive Loads, have all been incorporated in the design.

We call your attention to the following EXHIBITS which bring out REASONS why you should have COWAN EQUIPMENT.

EXH'T.1 : COWAN LONG LIFE SKIDS AND TOTE BOXES
Riveting feet to lower flange of angle in addition to bolting them to upper flange and decking gives greatest rigidity. Countersinking holes in decking for large diameter flat head bolts gives smooth deck. Spacing of runners gives guide for truck and centers load.

EXH'T.8&9: COWAN TYPE G HAND LIFT TRUCK
Easy lifting due to Cowan's patented lifting mechanism - Positive latch and easy kickoff through the use of Cowan's "off dead center" patent. Easy rolling due to proper bearings and Alemite greasing system. Lowering cushioned by means of approved check. Variety of standard sizes.

EXH'T.20 : COWAN MODEL LLT ELECTRIC LIFT TRUCK
Strength - Power - Simplicity - Capacity - Flexibility Ease of Control - Anti-kick Steer - Four Trucks in one: Lift truck, Load Carrying Truck, Pusher and Baby Tractor.

EXH'T.21 : FRAME FOR LLT DESIGNED FOR STRENGTH - Five Inch Channel, Bumper, protecting elevating platform, built into frame.

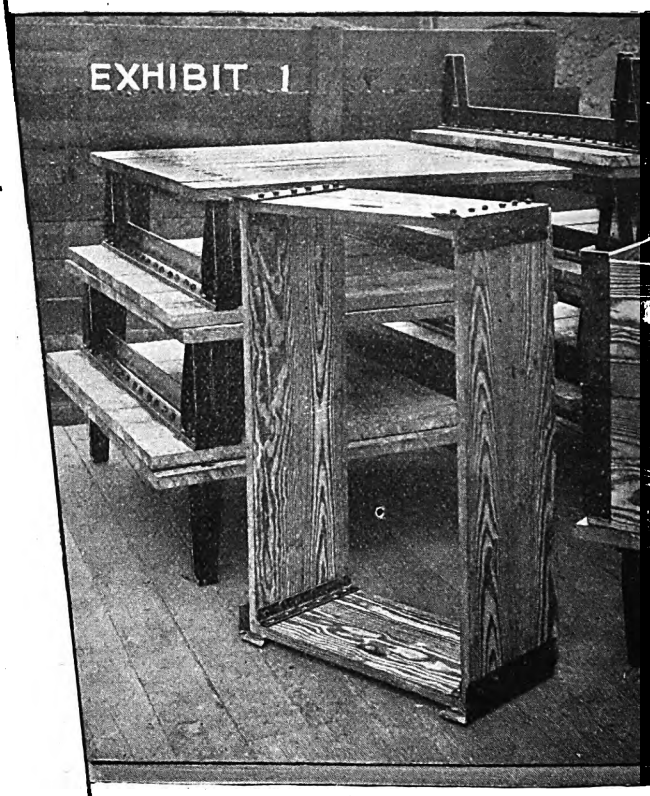
EXH'T.24 : COWAN MODEL LLT ELECTRIC TRUCK CHASSIS
Wiring system carefully laid out. Three point frame suspension. Crowbar method of lifting employed - most efficient of all methods. Bronze or steel bushings throughout. Alemite greasing system properly installed.

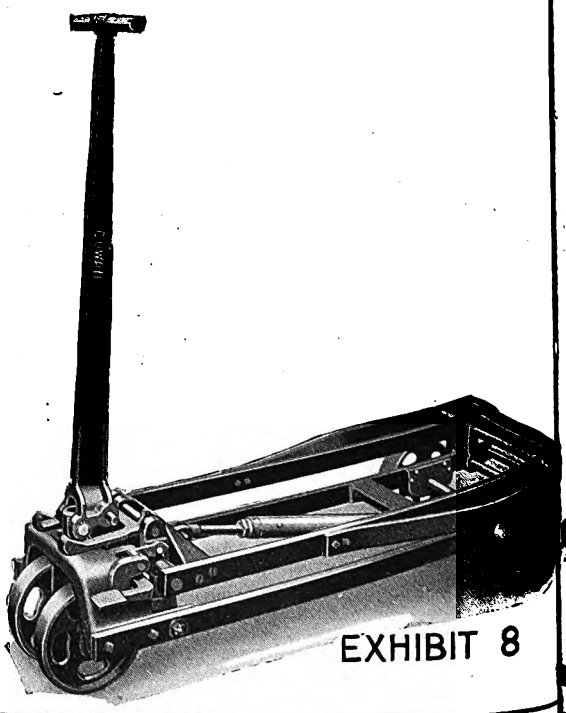
EXH'T.28 : COWAN LLT DRIVING UNIT
GENERAL ELECTRIC Motors - Over size brake - Automatic Control - Simplicity throughout - Mechanical and Electrical Accessibility.

These features put Cowan Equipment in a Class by itself. Cowan Trucks show absolute superiority in flexibility of application and ability to withstand service.

We will be glad to co-operate with you and will appreciate an opportunity.

Very truly yours,
COWAN TRUCK COMPANY
J. McEaton
GENERAL MANAGER





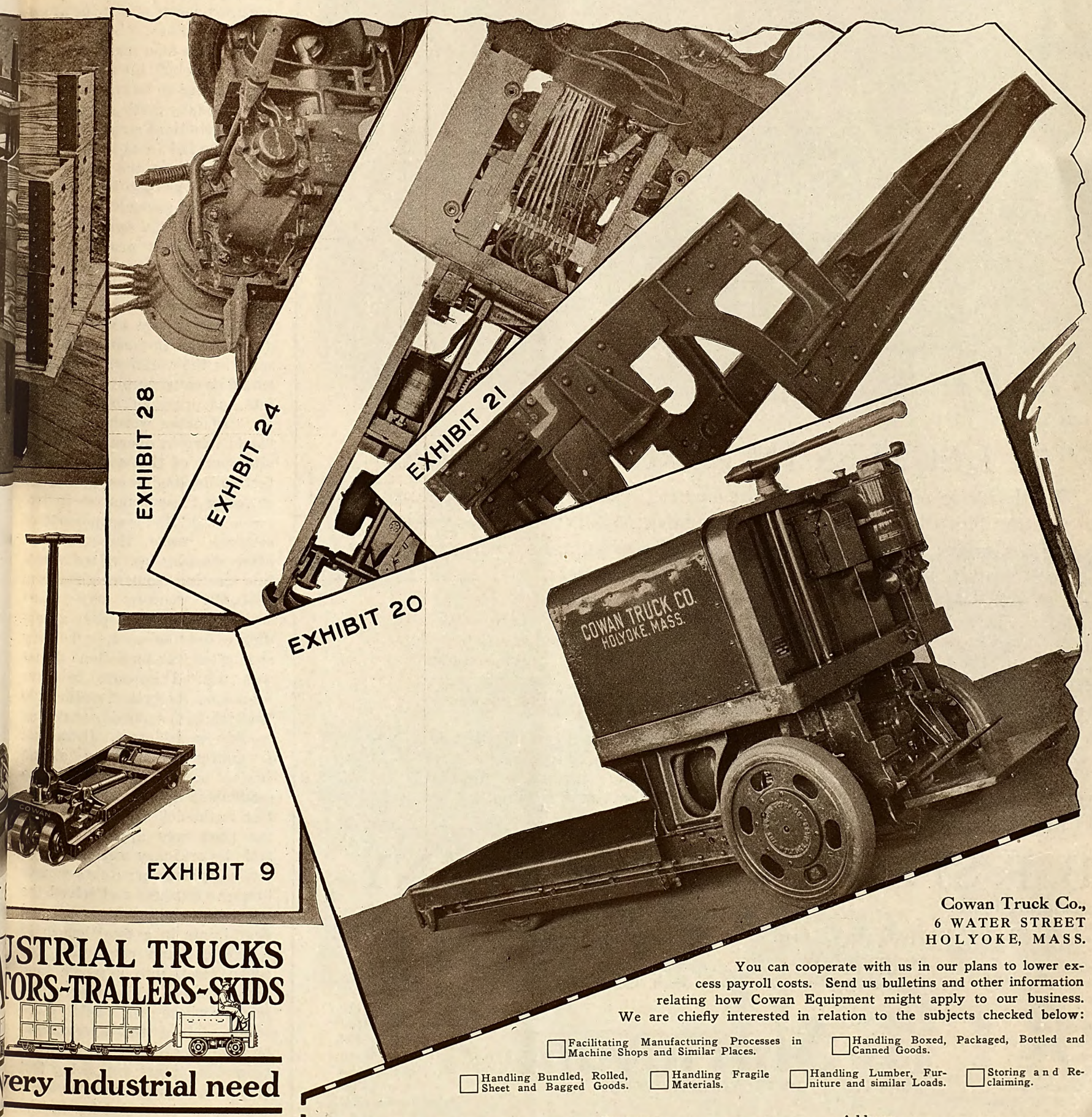


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y With Which They Approach Your Problems

where there is no call for increased production, and yet these same companies have a very urgent call for increased profits. An opportunity for increased profits without increased production presents itself in the form of Cowan Lift Truck Equipment. This equipment if properly applied will eliminate Handling and Re-Handling and in turn will reduce your *payroll* by an amount equal to many times the cost of Cowan equipment. A well known firm of Public Accountants has just figured out for one Company using Cowan Equipment that the payroll saving alone justified an expenditure for Cowan Equipment TEN (10) times as great as the actual amount spent. These figures are all certified and authentic.

COWAN TRUCK CO.



JSTRIAL TRUCKS
TORS-TRAILERS-SKIDS

very Industrial need

Cowan Truck Co.,
6 WATER STREET
HOLYOKE, MASS.

You can cooperate with us in our plans to lower excess payroll costs. Send us bulletins and other information relating how Cowan Equipment might apply to our business. We are chiefly interested in relation to the subjects checked below:

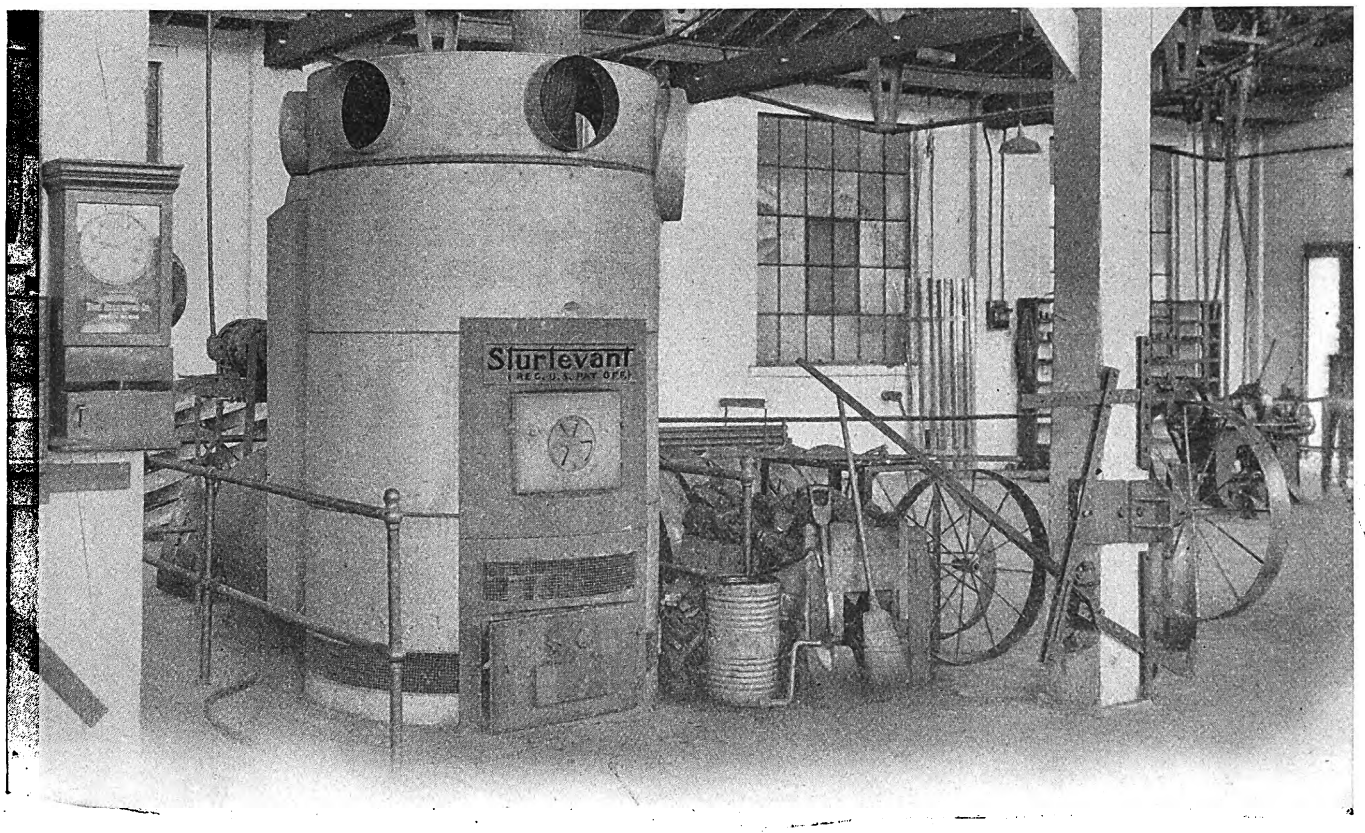
☐ Facilitating Manufacturing Processes in Machine Shops and Similar Places.
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☐ Handling Fragile Materials.
☐ Handling Lumber, Furniture and similar Loads.
☐ Storing and Reclaiming.

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(*Continued from page* 42)

lene process may be brought into this situation for the sole purpose of making the roof water-tight. An application of this kind was made early in the American history of the new art, as the writer knows from personal observation. There are very many cases indeed where the process is applicable, cases where the continuity of the metal across the seam is a matter of high importance. Some dozen years ago, a big steel water conduit was constructed in Colorado. The line was of considerable length and had to endure at points serious pressure from within. In fact, pressures ran up to something like 800 pounds to the square inch. I am excluding reductions for friction and the like. This pipe line, 9,000 feet in length, having a low level diameter of 3 feet 10 inches and a high level diameter of 4 feet 6 inches, was divided at the base for the purpose of serving two 10,500 horsepower water wheels of the impulse type. Our interest centers on the lower parts of the line, because of the events which followed the beginning of actual service. The pipe was shop assembled in sections of three lengths each. This meant a field union of sections at intervals of about 21 feet. There was a longitudinal joint made by riveting on cover straps of steel, wide straps inside and a single narrower strap outside. There were four lines of rivets, two to each side of the joint, and these held together three thicknesses of steel. The broad interior strap was additionally riveted to the pipe by two lines of rivets one line to each side of the aforesaid four lines. The circular joints were also made by girth straps riveted in place. The sections had to be connected up, in the field, by girth straps. And the longitudinal straps had also to be riveted in position where they overhung the pipe ends. The line was put into service. Leaks began to develop in a very short time. The caulking up of the field joints proved insufficient to hold back the pressure water inside the tube. The water, escaping with great force, threatened to extend the damage by the action of the sand in the vicinity. The sand would be caught up by the water jets and projected onto the rivets. In other words, wet sand blasts were in operation upon a vital part of the work. No effective method was known of stopping these leaks; so in November the line was put out of service, some three months after starting up. Here was a line costing somewhere round $250,000 (before the war) which was in large part a candidate for the scrap pile very soon after its completion. What was wanted appears to have been some method of sealing 200 field joints in such way that they would remain intact. It was not a matter of making strong joints, but of performing the equivalent of a caulking operation in the field in a manner better than was apparently possible by ordinary methods. The oxy-acetylene process was brought into use and solved the problem, sealing the external field joints in a total length of 4,000 feet and converting the cover strap into a single long piece of steel. There were also joints where the field girth straps joined the longitudinal band of metal, and these had to be sealed. Here was a big test for the new process. The work was done, in the field, in the



"55 DEGREES IN ZERO WEATHER"

THE above remark refers to the heating results obtained by Sturtevant Hot-Blast Heaters in the Geneva Metal Wheel Company's plant, Geneva, Ohio. Following are two paragraphs taken from a letter written by their purchasing agent, Mr. Sawyer.

"We have four of these heaters installed in our plant and have obtained very satisfactory results with them in our foundry, core room. We have been able to maintain at least 55 degrees in zero weather and have used as fuel the ordinary ¾" lump steam coal, which is purchased for our boilers. As to the exact amount consumed during the winter season, we are sorry to say these figures are not available, but we know them to be economical.

"We had a call from your representative who went over our installation with us, and there is nothing in the matter of service that we need at this time. The heaters are giving us complete satisfaction, and we would not hesitate to recommend them for industrial heating."

Bulletin A306 gives the details

B. F. STURTEVANT COMPANY

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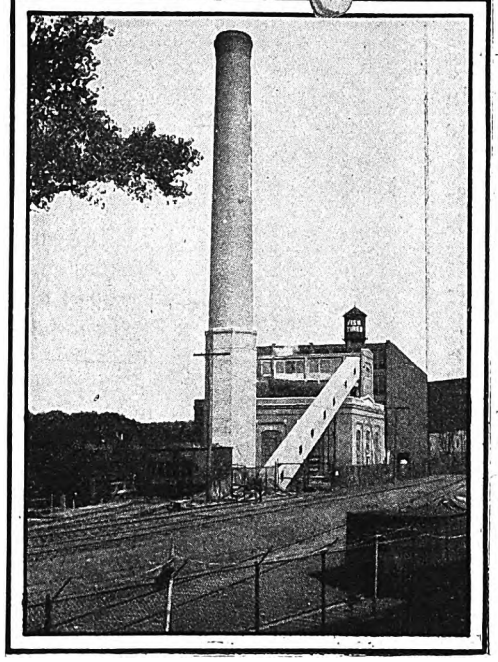
winter time, and was carried to completion in something like fifteen weeks, if we except some unimportant welds. The acetylene was generated on the spot and was successfully piped to points of use having a maximum distance of 500 feet from the generator. The oxygen plant was set up at a separated point, and consisted of a generating apparatus and a gas compressor. The oxygen was transported in a compressed state to various points along the line, a construction tramway being used or a horse-drawn stone-boat. The acetylene was manufactured from calcium carbide, some eighteen tons of this material being required. The oxygen was produced by the consumption of some twenty-three tons of chlorate of potash. It was necessary to heat water for the generators, because of the severity of the weather. One expert welder, assisted by four or five men, did the work of welding, totalling, it has been estimated, some 667 lineal feet. The general manager said: "The company is highly satisfied with the work, and feels that without this process of welding it would probably have been necessary to replace 4,000 feet of the heaviest portion of the pipe." Let this instance stand as a sufficient example of the utilization of the process for sealing purposes and as an illustration of the fact that the procedure lends itself to application in the field.

Among the repair jobs for which the oxy-acetylene process has been requisitioned is the reclamation of wheels of various kinds. For example, a tractor wheel has a break in the hub, which is of cast iron. A part is actually broken off. And the piece is nowhere to be found. Here is a situation which might keep the tractor out of service at a very critical time and for a considerable period, if it were not for such methods as those which have been developed with the gas welding processes. It is a job which the oxy-acetylene welder can do in his shop or out on the farm. He makes a mold and fills in the space occupied formerly by the lost piece. However, when a wheel of cast iron or other metal breaks across the rim or across a spoke, the welder is up against the phenomenon of expansion and contraction. The intense heat applied to the new metal put into the groove until it is in a molten condition means that this slug will contract very considerably upon cooling. The result may be either a pulling away from the sides of the break or a contraction of the spoke or rim resulting in a new break at another point.

In fact, we have here an illustration of one of the principal problems encountered in the development of the new processes. Localized heating results in expansions and contractions which may create as much new trouble as there is old trouble. It is perhaps not too much to say that in the early period of development this problem constituted one of the greatest obstacles to the spread of the new method. Big castings, calling for small repairs in the shape of a filling in of several small blow holes, might be fractured in a drastic manner in the very carrying out of the repair. But, it is also probably not too much to say that this danger is now pretty well understood amongst expert welders and also very good methods of preventing additional breaks and fractures. The great remedy consists in preheating the region in and around

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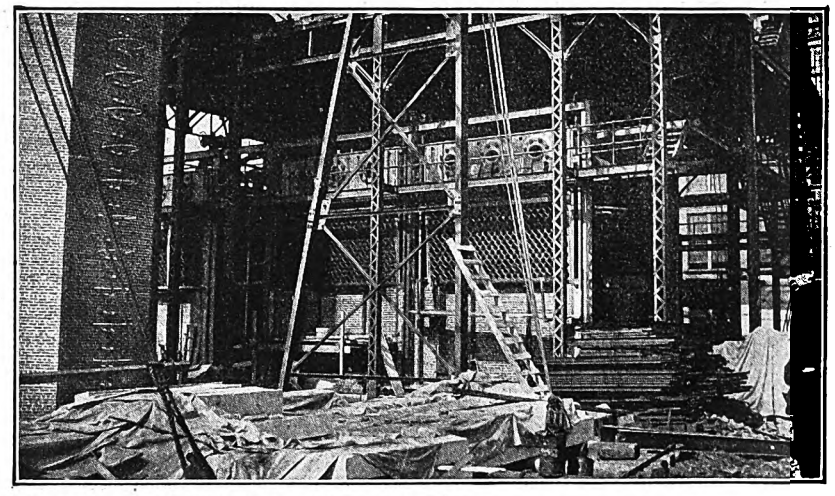
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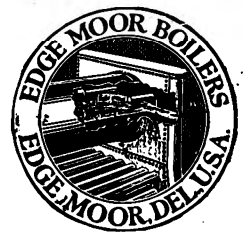
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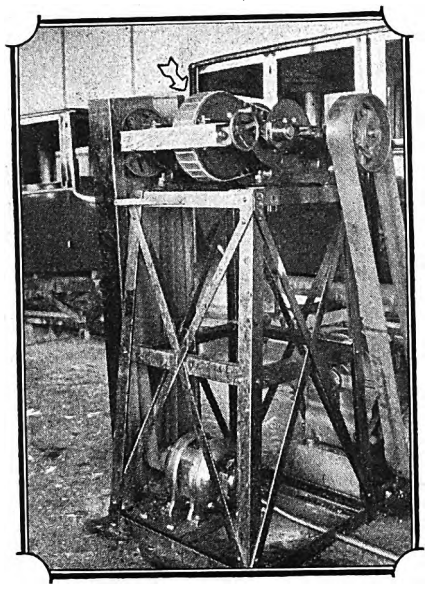
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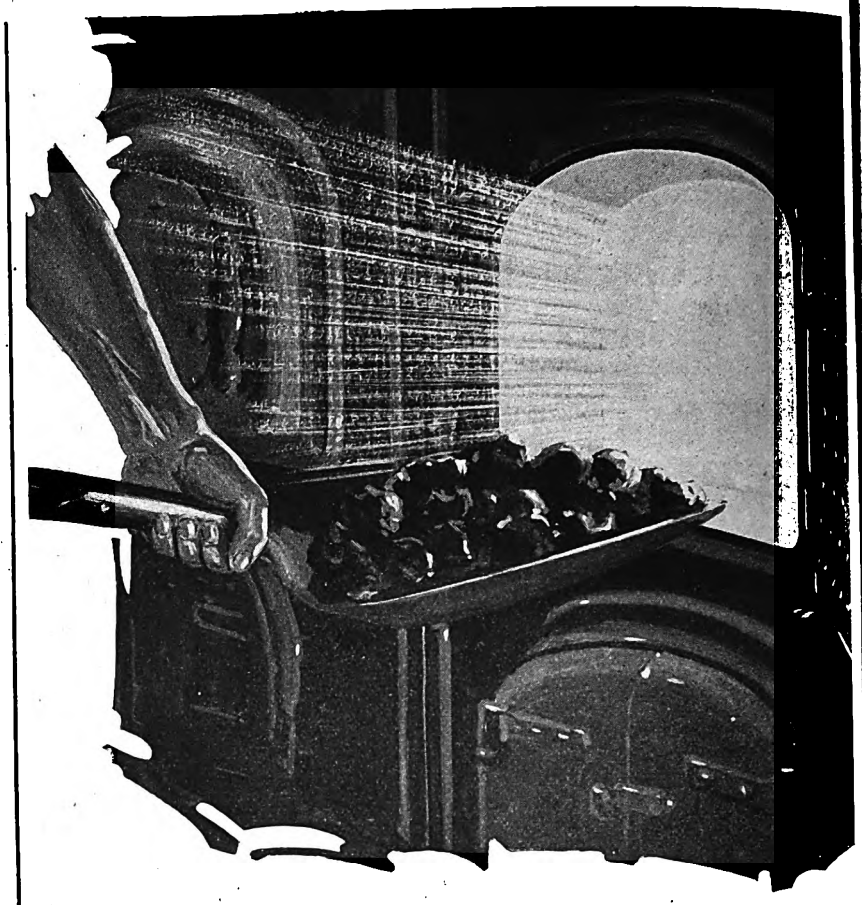
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the proposed weld or sometimes in pre-heating the whole piece. Special appliances have been worked out for handling such work.

The reader who is non-expert may think that pre-heating obliterates the localization of heating by means of the torch. This is, however, not the case. The local heating with the torch seeks to produce a molten condition or a condition nearly molten. Pre-heating falls far short of this. A red heat or a heat a little higher is probably that which is most customary. The heating of the general region of the weld or of the whole affair to a moderately high temperature and of the immediate vicinity of the weld to a very high temperature result in gradations of temperature and thus the metal has opportunity for adjustment. Heating compartments are employed in pre-heating and also other devices. The pre-heating may be done by a coke fire, a fire bed by oil or by city gas or other means. It need not be at all dependent upon the oxy-acetylene torch. On the other hand, the big enveloping flame of the torch may often be used to pre-heat the work. Thus, in welding a straight seam, the torch may often be so managed as to heat the immediate region of the weld in advance of the high heating performed by the inner white flame. This kind of thing may frequently be managed in cases where the welding is done by a power-driven welding machine. This brings us to the development of mechanical appliances for the carrying out of certain classes of welding operations.

When the oxy-acetylene process is adopted as the method of uniting the edges of sheet metal in repetition work, the power-driven mechanical appliance is, for many cases, the best and most economical means of carrying out the welding operation. For example, suppose it is desired to make day after day a great quantity of containers. There may be a longitudinal seam for the body and circumferential seams for the attachment of bottom and top. I may use this case as an illustration of advantages to be derived from machine welding. The sheet metal in the containers may be quite thin, and the joints may be made by melting two edges and allowing the molten metal to run together. In such cases,



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it may be very necessary that precisely so much heat—no more, no less—shall be continually supplied along the seams that is being made. An expert hand-welder can do the job, but it requires expertness and time. With a machine, the movement of the torch over this seam or of the work beneath the torch may be regulated so that it will proceed with great regularity. That is, the speed of making the weld can be made definite and regular. Moreover, the torch can be so adjusted relatively to this work that the hot spot will always be in its proper position. Some years ago, containers for the Edison storage battery were being made on two types of mechanical welding machines, and this procedure is perhaps still being used. One machine cared for the vertical weld in the body of the container, which was located a little distance away from one of the corners. The other machine welded the tops and bottoms in place. The material in use was steel plate that had been nickel-plated, and all seams were made by melting together two edges which were flat against each other.

A good deal of ingenuity has been applied to the design of seams in plate metal. There are many types of joint, and wisdom is needed in selecting the best for particular cases. In some instances, strength of seam will be wanted; in others, a smooth seam will be more desirable than a strong one. It is poor practice, in many situations, to place a seam at the exact corner of a container or vessel. And other precautions are more or less necessary. But, all this line of things has been pretty well worked out. Steel barrels and steel tubing are two lines in which machine work is serviceable.

The possibility of using the oxy-acetylene process in the cutting of steel has been highly developed. So also with cutting by the oxy-hydrogen procedure. By adding a jet of pure oxygen to the ordinary heating torch we produce a cutting instrument. The operation is representatively carried out as follows. First, the point at which the beginning of the cut is to be made is heated up without the oxygen jet. When the steel is red hot or hotter, the oxygen is turned on for the special jet. The torch may then be used almost as a saw. Tangled steel resulting from the collapse of steel structures can be readily cut up into manageable pieces. Heavy slabs may be cut across. Great bars may be severed. The cutting operation may in fact be carried on by the aid of mechanical appliances, and in this way both plain and complicated repetition work roughly cut to shape. In the foundry, particularly the foundry making steel castings, the oxy-acetylene process is especially serviceable, because the excessively hard protuberances that are not wanted may so readily be cut off.

The condition of trade and finance augurs well for 1924, and it can fairly be said that our outlook is one that every other country of the globe would gladly exchange for its own. Our industrial position is one of strength, without the appearance of embarrassing supplies of unsold goods which might seriously threaten the current price structure. Our labor is well employed at high wages, and was never before so well off as now. —*The Mechanics and Metals National Bank.*

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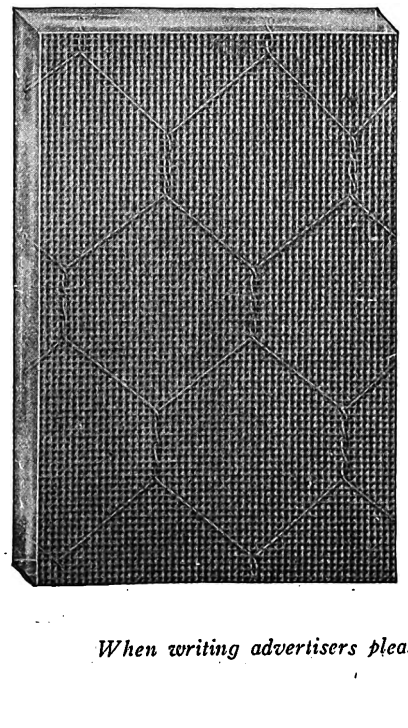
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(*Continued from page 17*)

they land. Not I. Writing American biographies has taught me that many a scared, outlandish, penniless lad who has had to run the gauntlet across Battery Park and up Broadway in his queer clothes without a word of English to answer back with, has written his name larger across the skies of this, his land and yours and mine, than many of us whose pedigrees go back to the Mayflower—has led the human race farther along the road of its destiny than the thousands who jostled him because he was a "foreigner." Had you stood by the causeway at Castle Garden on a day in 1870 would you have dreamed that you and the world were going to be eternally indebted, for those things you have before you tonight, to that unimpressive German-Jewish boy of nineteen you saw crossing there with his bundle? We are proud of America's leadership in the invention and use of the telephone. Who were the Americans who brought that about? Bell, the Scotch-Canadian; Berliner, the German; Pupin, the Serb! But Americans all, after all!

Our young immigrant went immediately to Washington and has always made his home in that city excepting a few years in New York and Boston. From a musical mother and a scholarly father he inherited artistic and studious inclinations which forbade idling away his spare time. He had finished the public schools in his native city of Hanover and he continued studying during his evenings, becoming especially interested in physical science. He found time, too, to carry on his violin music and to develop his talent for painting in no small degree. In New York he attended the free evening classes of the Cooper Union. For six or seven years he kept up this night study of science, turning his attention gradually to electricity more especially and fitting up a small laboratory for experiments with that form of energy, which they then were still calling a fluid. He was familiar with the attempts which were being made to invent a speaking telephone and in 1876 he began repeating the experiments of others and endeavoring to improve upon them. It took the dramatic enthusiasm of Dom Pedro at the Centennial Exposition to arouse the interest even of the scientists in the insignificant booth tucked away behind a staircase where a young Boston teacher of deaf-mutes at the last moment had been permitted to exhibit the first instrument of that line of marvels of which the latest is the telephone at your elbow.

The significance of that primitive telephone lay in its potentialities. As it stood it was only a scientific curiosity, a toy, of no use in the everyday service of humanity except as entertainment is useful. Only a trained speaker, enunciating his words with utmost distinctness and with his mouth pressed into the mouthpiece of the transmitter, could make himself plainly heard and understood for more than a few words at a time. Receiver and transmitter alike were actuated by magnetos, just as your receiver is today. The

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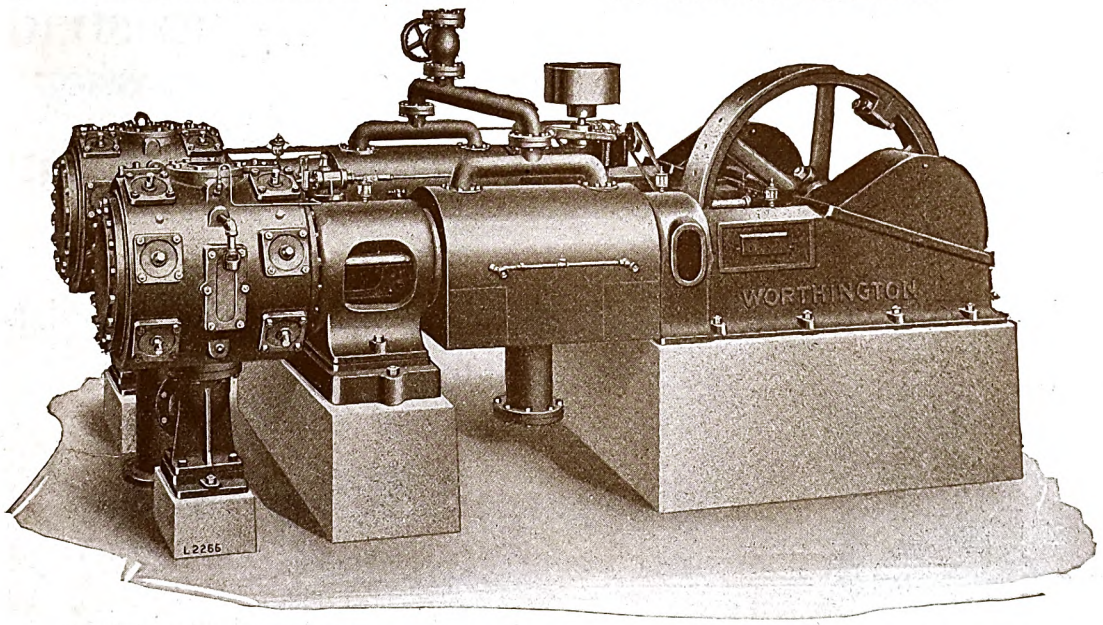
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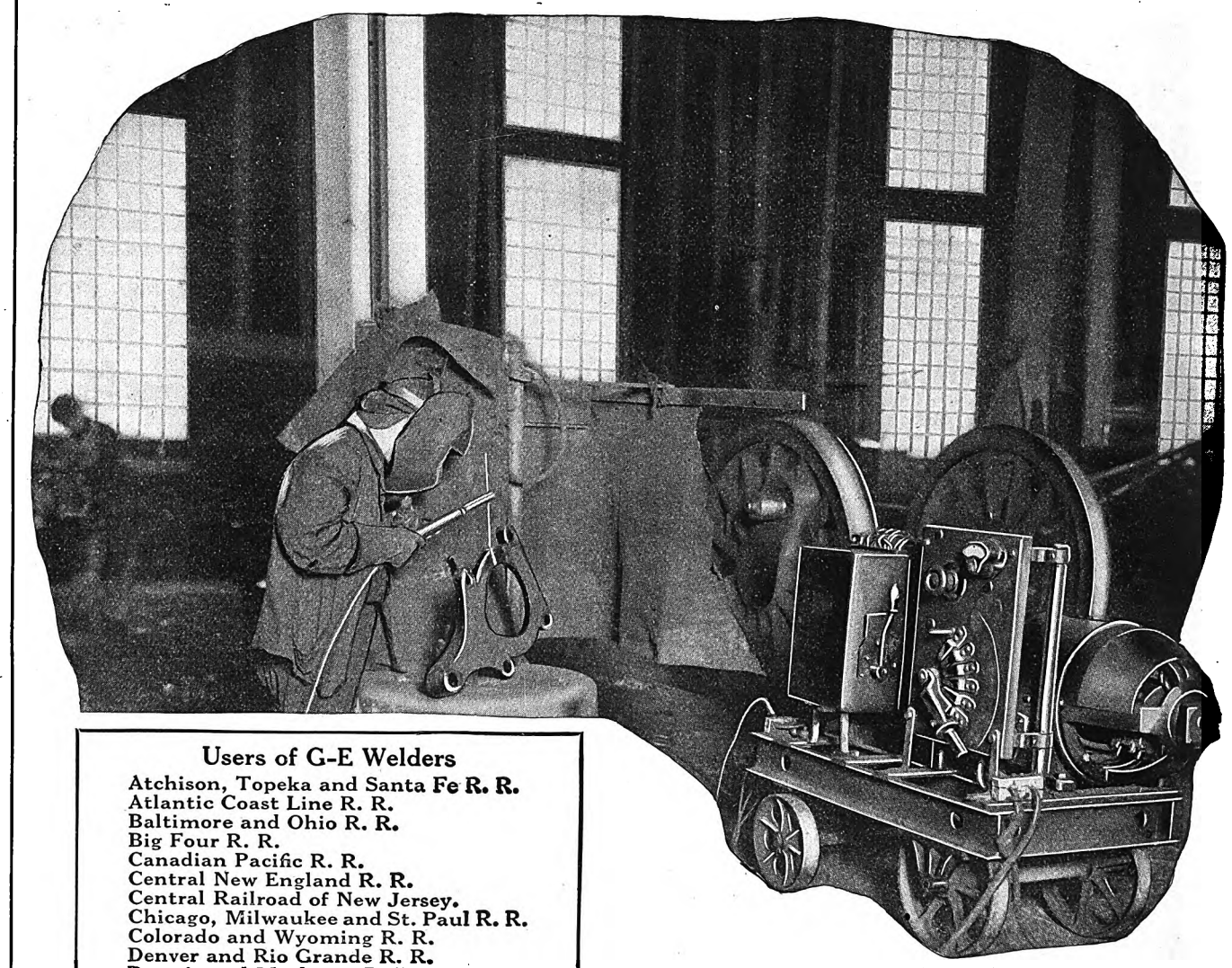
diaphragm was an animal membrane with a small disc of iron glued to its center to serve as the magnet armature.

Young Berliner grasped the significance of this crude appliance and its shortcomings as well, and he was spending his leisure hours almost entirely on experiments with it. As he tells it, "I thought it might be possible to use a battery current instead of the magneto, and to get the necessary electrical vibrations by varying the quantity or energy of the current instead of by the undulations of a continuous magnetic current. I did not catch on right away to the mechanical pressure principle for maintaining continuous contact at the vibrating point, and made several futile experiments." Here comes into play that combination of imagination or vision, deep and extensive study, and training of eye and hand, which characterize the practical inventor. The telegraph being an electrical means of conveying signals, Berliner had studied it profoundly both as to principles and practice. He learned to operate and one day about this time while he was in the fire alarm central office he started to show his friend Richards, who was chief fire alarm officer, what he could do in the way of telegraphing a message. In a minute Richards said, "Hold on, that isn't right. You must press the key down hard, not simply touch it, or the man at the other end won't get it." Berliner asked, "Do you mean to say that more current passes over that contact when I press hard?" Richards replied, "Exactly," and Berliner bolted out with the remark, "All right. Good-bye. I've got it!" He had, and he knew it. He rushed home, rigged up a diaphragm, using a highly polished steel button for a contact point, and connected it with his galvanometer. When he pressed his steel button harder, although it was all the time in contact so the current was passing through it, his galvanometer needle was deflected, giving evidence that he had accomplished his purpose of producing variations in a continuous current by altering the mechanical pressure at the contact point.

That was heresy. If there was any decalogue in electrical science, the first commandment in it was that thou shalt not tolerate a loose contact anywhere in your circuit. It could not conduct the current properly, it would burn out the terminals, and the sin brought various other penalties on the head of the violator. Today's heretics even do without wires! Berliner, working his discovery out, went a step farther and eliminated the skin diaphragm, making it entirely of sheet iron, and got infinitely better results. He did not know that Bell meanwhile had discovered the same thing about the diaphragm. In the course of these experiments he evolved probably the simplest electrical telephone ever made, merely a sheet iron diaphragm with a steel ball pressed lightly against its center. With two of these hooked into an electrical circuit, when a friend spoke into one he heard him through the other, three stories below.

Here was an instrument radically different from the Bell magneto telephone, and he filed a caveat in the Patent Office in April of 1877. Fourteen years later, fourteen years of fighting, he was granted a patent over

(*Continued on page* 53)



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(*Continued from page* 51)

claimants whose names are the names of the great in the electrical world. But the loose contact principle which he had established was not much more than a principle. He had not yet evolved a practical device for its application to every-day requirements, for it was incapable of stable adjustment. The very passage of the current through the restricted point of contact heated the points and broke the contact, necessitating constant re-adjustment. Here was a difficulty. Time to quit? Another famous American, asked that question, fired back the answer, "Surrender? Tell them I haven't begun to fight!" Berliner's resources, in intellect and patience, have never been exhausted yet; they have barely been tapped. He has an open mind—open at both ends. Its explorations are not arrested in the one direction by any closed, prohibitory doors marked, It Can't Be Done, It Must Not Be Done, or It Isn't Being Done; nor, in the other direction, is it impeded by the inhibitory formula of self-satisfaction: I have gone farther than anybody else, and that is far enough.

No; the fact that the door had opened a crack was proof that it could be swung wide. He had pried open that crack by doing something against the rules, and, if it stuck, there must be a way of applying leverage to the door, or lubricant to the hinges, that would make it open. The line current running through the instruments heated the contact points. But you had to have a current through the instrument to initiate the impulses. There must be a current over the line to transmit them. Current must run through the receiving instrument to receive the impulses and convert them into sound waves. Consequently you had to have a current running through the line and through the instruments; you could not deprive the instruments of electricity just because it heated them up. Wait a minute! Wasn't there a way to accomplish that paradox of cutting the instruments out of the line and yet supplying them with current which could transmit and receive electrical impulses to and from the current in the line? Yes! with an induction coil!

Again he had it. Berliner connected up his line wire with the secondary helix of an induction coil at each end of the line, and connected the primaries of the induction coils with the battery and loose-contact points of his telephones. Early in 1878 he received a patent for this latest improvement. These two improvements, the loose-contact transmitter and the use of the induction coil, were vital links in the commercial development of the telephone industry of the next few years. But for them it came near to being the Western Union Telegraph & Telephone Company instead of the Bell, or American, company as you know it today.

The Western Union Telegraph Company saw in the speaking telephone a competitor likely to make serious inroads on its business, so it proceeded to take the offensive by going into the telephone business itself. Bell and his associates were but a group of experimenters with little capital, while the Western Union was one of the largest corporations in existence at that time, with millions of capital, thousands of offices and wire lines already installed the coun-

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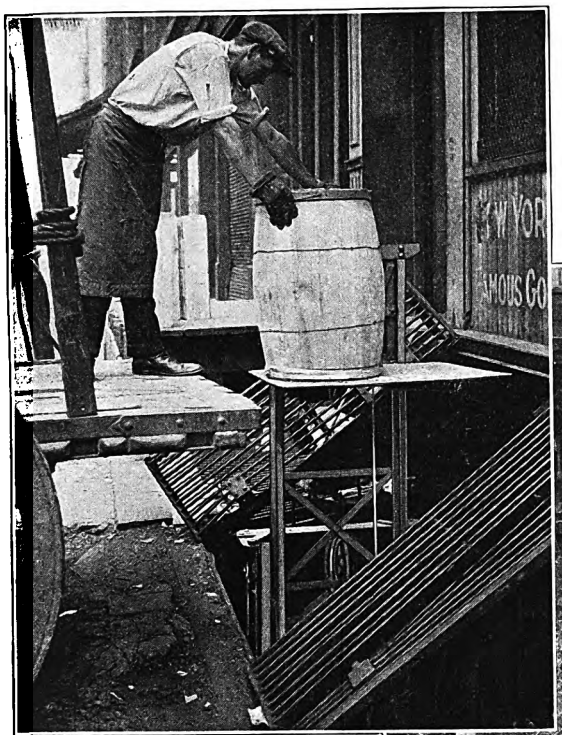
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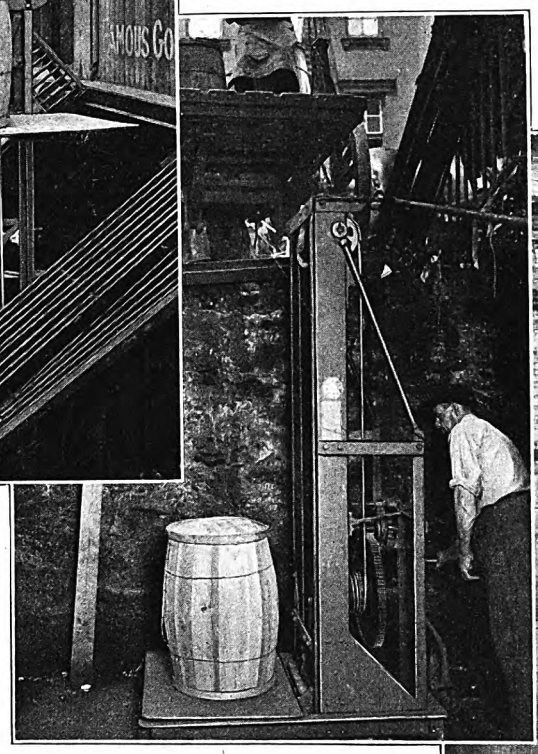
try over. If ever a David was confronted with a Goliath, this was the time. The telephone was far from a perfect instrument and therefore was capable of vast improvement. The Western Union, with its almost limitless resources, engaged the most eminent electrical experts —Edison, Gray, Dollbear—to solve the problems involved. Legal talent of equally high order attacked the patents. The Bell attorneys, studying the several telephone patents, ran across Mr. Berliner's and advised their principals that here were some patents they ought to control. They took the advice and made a contract with Mr. Berliner so he became one of the Bell group.

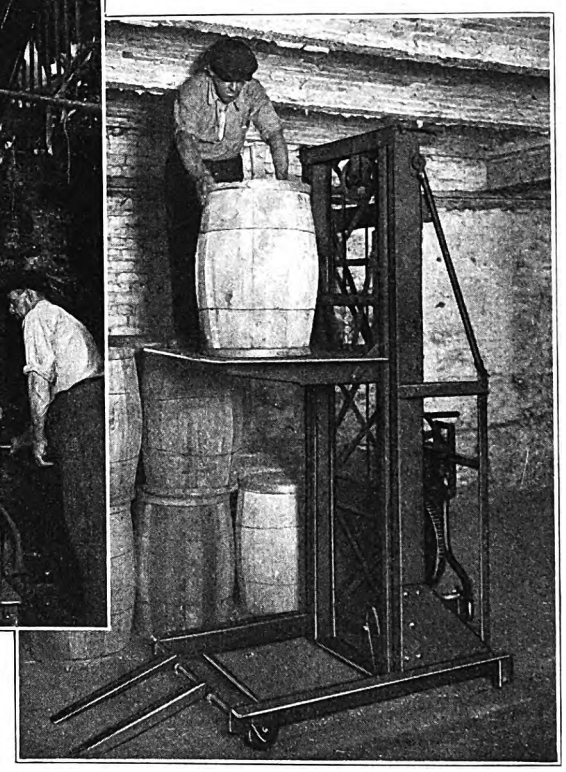
Meanwhile Francis Blake, Jr., had experimented with the loose-contact transmitter and brought out his adaptation of it as the standard Bell instrument. He had a special way of mounting the contact points and used carbon—arc light carbon—for the "button" point, while the other was a metal bead. The transmitter was extremely unsatisfactory in service, however. It would not remain in adjustment more than a few hours. Overnight it would become completely useless. Mr. Blake's health failing, he had to withdraw from active service, so the company sent for Mr. Berliner and put up to him the problem of perfecting the Blake transmitter. He soon found that the difficulty lay in the softness of the carbon. The metal bead, by its constant vibration, dug a hole in it. As he had used gas carbon to make the button point in his own transmitter and knew how much harder it was than electric light carbon, he decided to use it again in the Blake instrument. Gas carbon was too hard to work with tools, so, drawing on his ingenuity again, he made his buttons of the soft carbon, put them in a steel cage, had the gas company put them in its gas-making retort, and they came out coated or penetrated with the hard gas carbon. And the Blake transmitter was finished! Previously they had been made laboriously and slowly, one by one, and no two exactly alike. It took a trained man to adjust them and a trained voice to speak with any satisfaction through them. Now all that was changed. Action was positive, adjustment permanent, and the "boomy" distortion of the voice disappeared. Orders were given to turn out two hundred a day, and Mr. Berliner personally inspected the first 20,000 instruments before turning his attention to other research work.

This was the stone in little David's sling, for with it he killed off Goliath. The Western Union electricians were getting no nearer to a satisfactory improvement of the telephone, while the comparative perfection of the Bell service with its Bell-Berliner-Blake instruments was attracting subscribers faster than either mechanical or financial resources could supply them. The vital advantage of the Bell system lay in its transmitter. So the Western Union capitulated and withdrew from the telephone business on the agreement of the Bell Telephone Company not to compete in the telegraph field.

In principle that transmitter has never been changed although of course in construction there have been considerable improvements. In the course of the patent litigation, several years after he invented it, Mr.







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If you have such places where you wish to use a piler, this new Economy Telescoping Portable Elevator will do the work as no fixed height machine can. Write for working model showing how it is done.

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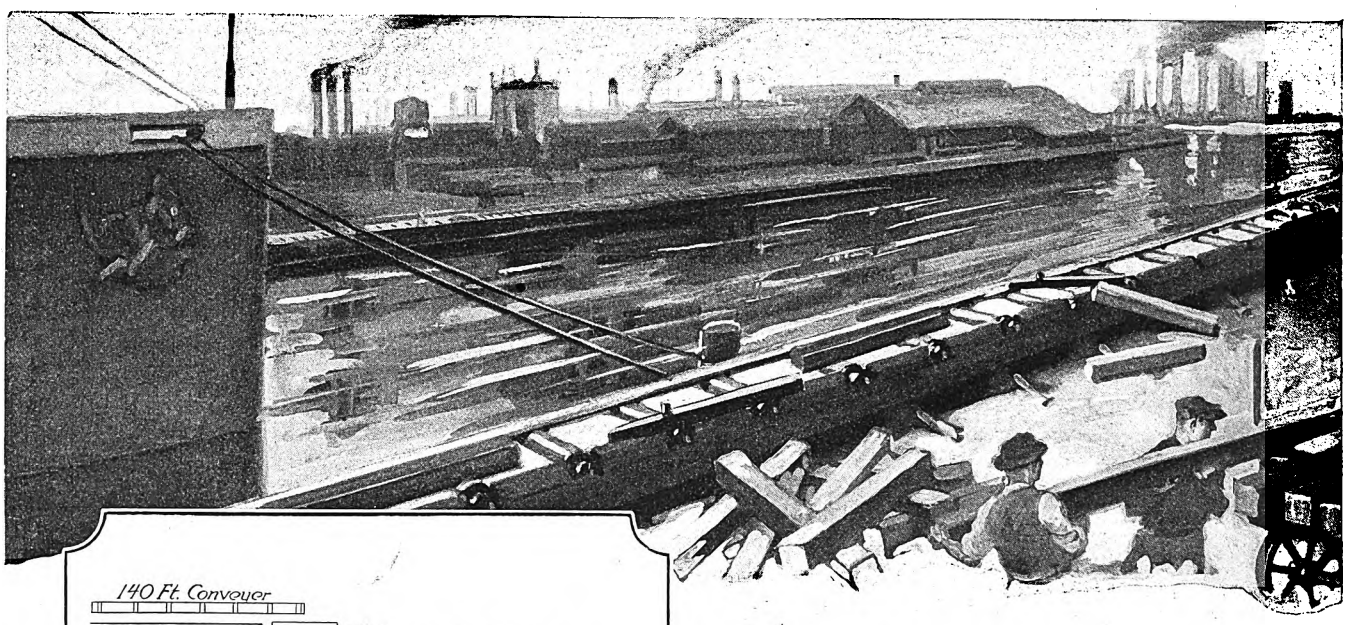
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Berliner gave an interesting and convincing demonstration of the fact that his caveat, filed early in 1877, described the elements of a completed invention, utilizing a loose contact between the electrodes. In the Bell Telephone Company office there gathered an imposing company of government attorneys and patent experts, telephone lawyers, scientists and professors. The government men were in the position of contending that, since Mr. Berliner had not mentioned carbon points as essential to his invention, other claimants who did specify carbon had superior rights. Mr. Berliner, in the presence of this distinguished group, took an ordinary learner's telegraph key, with metal contact points, of course. He removed the heavy spring and replaced it with a light relay spring, adjusting it carefully until he had a very light, loose contact at the points, so he could hear the ticking of his watch, laid on the baseboard of the key. Then he had the government's attorney, to that gentleman's astonishment, simply talk at that Morse key and the government man with a telephone at the other end of the wire, downstairs, heard all he said. That silenced all opposing arguments. It proved that what Berliner had described in his caveat was a real telephone.

Not only could he discover principles, devise and produce apparatus to apply them, but he could set it all down in clear language, for he wrote that caveat himself. The Bell Telephone Company's leading counsel in much of the subsequent litigation once told Berliner they wished he had also written his patent application himself, instead of having a lawyer do it. It would have saved them a lot of trouble in getting it recognized and granted.

Edison, while experimenting with the telephone, struck a trail which led to his invention of the phonograph. Berliner's work followed much the same course. In Edison's machine the record was made on a tin-foil cylinder with a needle or stylus which vibrated vertically, making a helical groove of varying depth corresponding to the voice vibrations. Berliner saw there would be several advantages if the record groove were made in a flat spiral on the surface of a disc, with the vibrations appearing therefore as horizontal waves. The most important advantage would be that the stylus would cut its groove through a coating on the disc of even thickness and therefore of uniform resistance, whereas a needle cutting vertically into wax (tin-foil having been superseded) met a variable resistance, increasing in an increasing ratio with the depth of the cut. Another factor was that the spiral groove would both vibrate and propel the reproducing stylus. Again, duplicates of the record could be made directly from it by electro-plating or some other contact method. His knowledge of music and his profound study of sound in connection with his telephone inventions and research stood him in good stead when he directed his energies in this new path, eight or nine years after the first phonograph appeared. Space will not permit following the steps by which Berliner developed his ideas into a practical mechanism in a little over a year from the time he started. On May 16, 1888, he read a paper at the stated meeting of the Franklin Institute of Philadelphia in which he was



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FOR CONVEYORS AND MATERIAL HANDLING EQUIPMENT

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able to say: "In nature provision seems to be made for all the wants of mankind. Confident in this belief I kept on trying to find a trail which would lead to promising results, and I have the honor tonight, for the first time, to bring before you this latest achievement in the art of producing permanent sound records from which a reproduction can be obtained, if necessary, within fifteen or twenty minutes, and which can be accurately multiplied in any number by the electrotype process. It may be termed, in short, *the art of etching the human voice.*"

In the same paper Mr. Berliner, suggesting the "practical applications" of his invention, made a number of predictions of such startling accuracy that it is interesting to repeat a few of them. He said: "A standard reproducing apparatus, simple in construction and easily manipulated, will be placed on the market at a moderate selling price. Those having one may then buy an assortment of phonautograms (records), to be increased occasionally, comprising recitations, songs, vocal and instrumental solos or orchestral pieces of every variety. . . . Prominent singers, speakers or performers may derive an income from royalties on the sale of their phonautograms. . . . Whole evenings will be spent at home going through a long list of interesting performances. . . . Languages can be taught. . . . Addresses can be delivered by proxy."

And then the audience listened to the first gramophone program: Yankee Doodle; Nancy Lee; Home, Sweet Home; Annie Laurie; a cornet solo; the Declaration of Independence. The original metallic records and one copper duplicate made by ordinary electrotyping were used for this demonstration. It took Mr. Berliner five years more to work out the present method of duplicating records by pressing an electrotype reverse of the original into softened rubber, celluloid or shellac compositions. Innumerable other improvements and refinements kept his inventive ingenuity busy until the day has arrived when a prima donna can stand beside the instrument and if she makes the motions of singing the hearers cannot tell whether the music they hear comes from her throat or from the machine.

The Franklin Institute has awarded him the John Scott and Elliott Cresson medals for his important contributions to the development of the telephone and the talking machine, but his work has not been confined to those instruments. With his eager mind roaming far afield in the domain of applied physics, Mr. Berliner has done considerable experimenting with helicopters as a means of aerial flight. Again, he addressed his painstaking genius to the airplane engine and developed a 90-horsepower, duplex, gyro motor, weighing but 215 pounds. On November 1, 1914, with this motor installed in a Dayton tractor plane at College Park, Washington, De Lloyd Thompson, from an altitude of a thousand feet, climbed 2,800 feet higher in three minutes. A great deal more could be said about this achievement, marking Mr. Berliner as the first to succeed in making the lightweight, internal combustion engine with revolving cylinders now so extensively used in air-

(*Continued on page* 58)



An Investment of $400,000.00 in Jeffrey Carriers *by* 6 Industrial Leaders

The six Industrial Leaders whose well-known trade marks are featured above, are using 16 Jeffrey Pivoted Bucket Carriers for the handling of large quantities of bulk products such as coal, ashes, sugar, vegetables, etc. The Jeffrey carrier is specified wherever year-in and year-out service without shutdowns is required.

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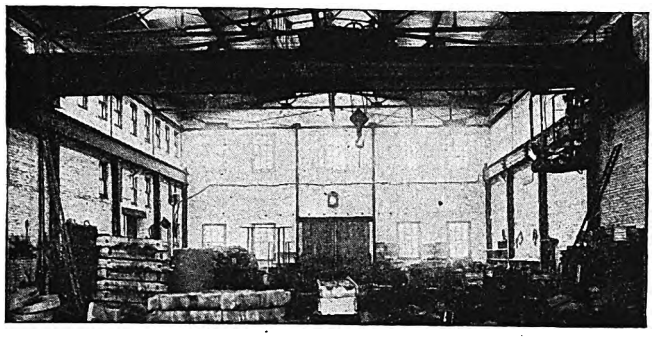
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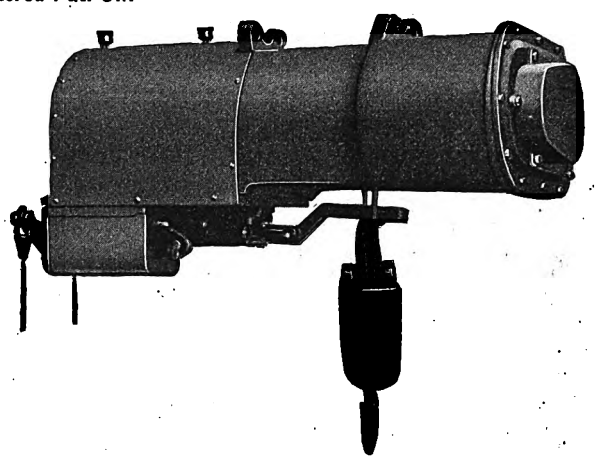
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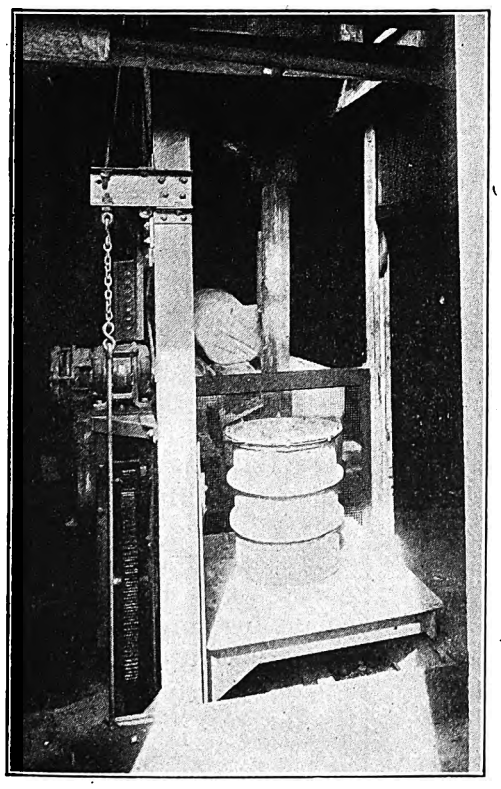
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Roller bearing. — Short headroom.
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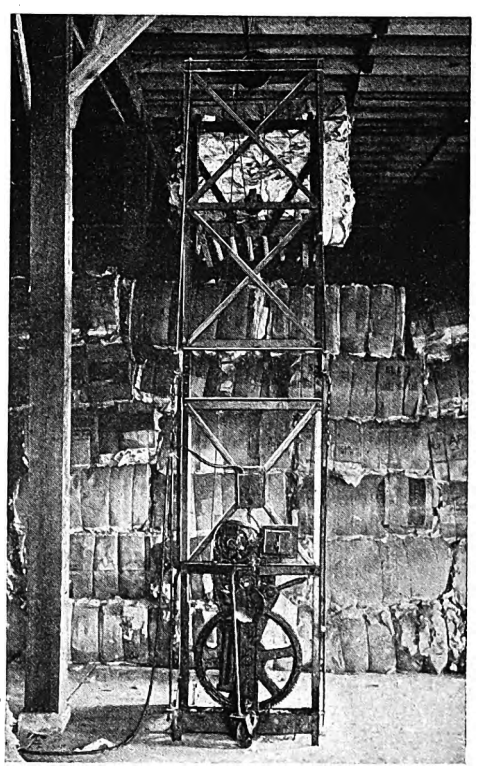


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SINGLE DRUM, TWIN DRUM OR 4 POST MACHINE FOR PORTABLE OR FIXED USE.

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80 Distributors **Incorporated 1885**

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(*Continued from page* 56)

planes, particularly in European practice.

And now we must not overlook, even in so brief a sketch as this, an intensely human side to Emile Berliner's character and life work. When he had lost one child and came near losing another his inquiring mind sought the reason and found it in the impure milk which was served the household. Realizing that the effects upon his own family must be multiplied many times over throughout the city and nation, he saw the enormous proportions of the harm that must be due to the milk supply. Studying that broader aspect of the question, he learned how much infant mortality, typhoid fever and tuberculosis could be traced to the same source. In 1901 he organized the Society for the Prevention of Sickness and ever since has devoted a considerable part of his energies and funds to a widespread campaign against the dangers of raw milk and in favor of pasteurizing the milk supply in addition to more stringent sanitary control of its production and transportation. In that work he claims only to be following in the footsteps of Nathan Strauss, who blazed the way in New York City. But Mr. Berliner, by planning the first Milk Conference, in Washington, attracted the attention and support of the Federal Government and therefore was a powerful influence in giving the campaign a national character and correspondingly greater effectiveness. By himself and in collaboration with others he has written and published a constant stream of pamphlets and articles in that warfare against preventable filth disease. Its results are seen in his home city in an amazing reduction in the morbidity and death rates.

His is a life of decisive and far-reaching achievement, in no single field, but well-rounded withal; a personality strongly marked, but in traits of such range that it is well balanced. "The elements so mix'd in him

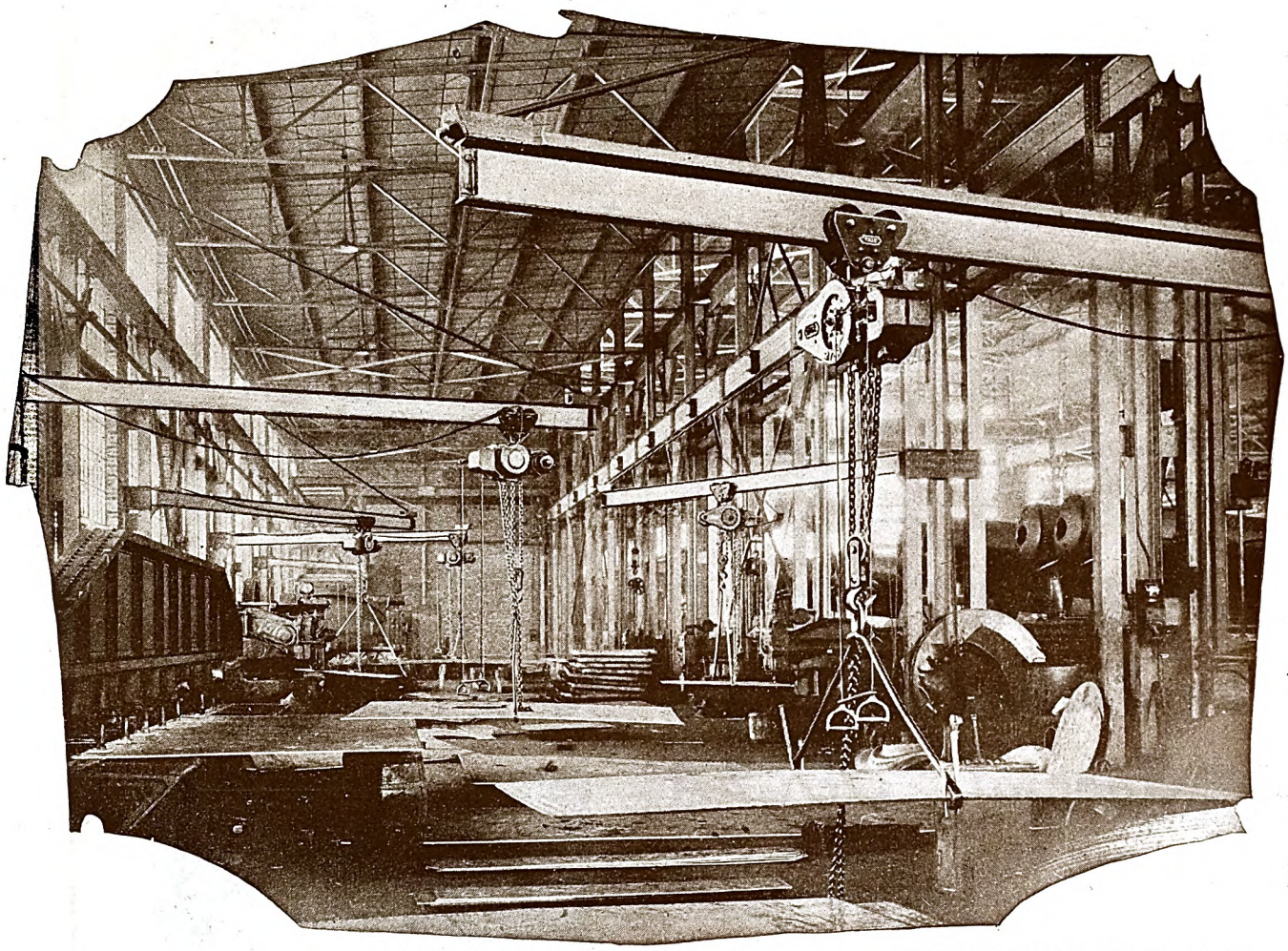
That Nature might stand up
And say to all the world,
'This was a man.'"

The arts and sciences; painting, music and physics; mechanisms and the humanities; genius that has imprisoned the voices of great singers in imperishable copper and made possible the fourteen million telephones of today in this country alone, and a heart that is just as keen and indefatigable in the fight for national health—these are not inconsistencies, they are but the different facets of a many-sided nature.

What has been Emile Berliner's greatest service to humanity? Is it the telephone improvement that determined the destiny of the industry? Is it the instrument which will enable posterity to hear Caruso? Or will it be some leader of the race, some genius, whose life was saved in infancy by his fight for pure milk?

Some far-off day, when his perspective is great enough, he will know.

Cleaning tests of small sizes of central Illinois coal have been completed by engineers of the Department of the Interior attached to the Urbana, Illinois, experiment station of the Bureau of Mines. These tests, which have been checked in commercial coal washing plants, show that it is entirely practicable to reduce the ash content of the screenings.



Yale Electric Chain Hoist installation at the Union Iron Works, Erie, Pa.

A Unique Application of Yale Electric Chain Hoists

THE use of the 2-ton Yale Model 20 Electric Chain Hoist on the bull riveter shown in the foreground of the above photograph, furnishes a most interesting example of Yale methods. This hoist and the bull riveter replaced an expensive electric riveting outfit at a saving of several thousand dollars.

The bull riveter is stationary and the assembling work is spotted by the Yale Electric Chain Hoist. This requires frequent movements of from two to three inches between operations.

Six other 2-ton Yale Electric Chain Hoists in this plant are used on jib cranes serving punches and shears handling heavy plate and structural work in and out of the tools.

Of first importance in this work is accuracy of load spotting. The work must be practically level and in the right position when punched or sheared. The fact that six Yale Electric Chain Hoists, all mounted on the new Steel-Plate Roller Bearing Trolleys, have been installed is ample evidence of the value of this Yale combination for such work.

Write for complete information about the Yale methods of handling heavy, bulky loads quickly, safely and economically. Yale Chain Blocks, Electric Hoists and Electric Industrial Trucks have been applied in every industry with the result that production has been speeded up, handling costs reduced and profits increased.

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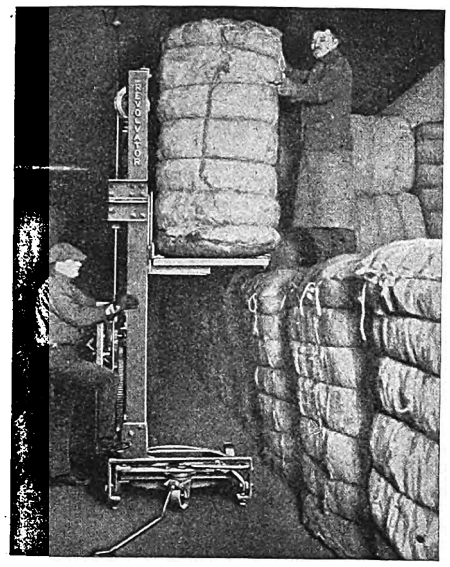
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These 12 companies are operating 300 Revolvators. An average of 25 each. One has 40; all have over 15 Revolvators.

MORE PILING OF MATERIAL WITH FEWER MEN

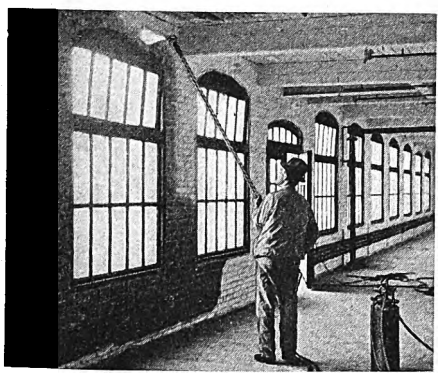
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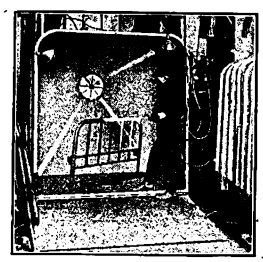
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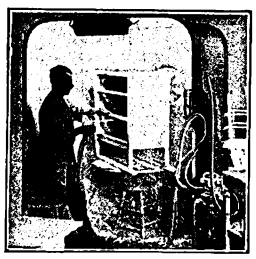
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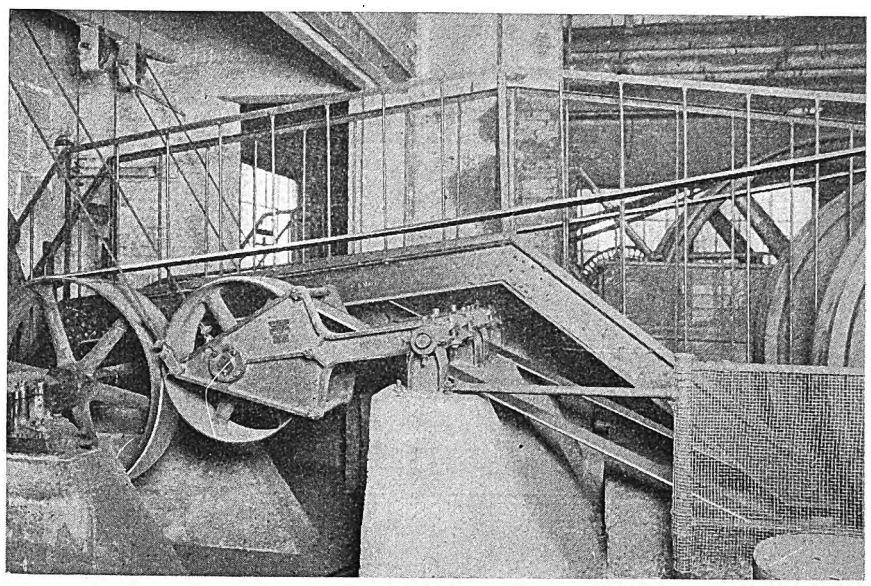
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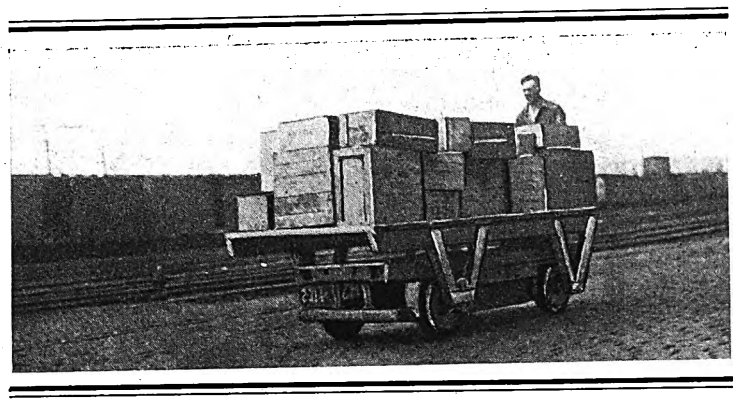
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And remember the short turning radius means manoeuverability in the cramped aisles and blind alleys.

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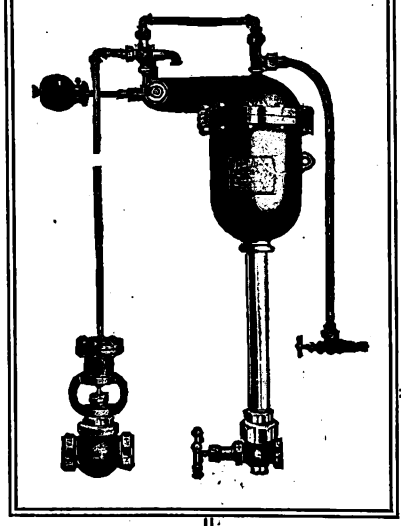
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Feed Water Regulator

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There are no tubes, floats or diaphragms to cause trouble; the action is entirely automatic, absolutely reliable and gives the greatest operating efficiency with a low fuel consumption.

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Health, Production, and the Plant Plumber

(*Continued from page* 16)

of heating finds an excellent application. In these buildings, having large cubic contents and comparatively few men, the purity of the air is not affected very much by recirculating it. These unit heaters or space heaters are of various types, some being heated by steam with a motor-driven fan, some using steam to drive a turbine-driven fan, making use of the exhaust steam for heating and others being heated by gas or coal and having motor-driven fans. These units are also used as auxiliary heaters in severe weather when the regular heating equipment will not raise the temperature.

The best way to control the temperature of the various rooms in a plant is by installing a temperature regulator in each room. There are several of these on the market and the saving in steam will soon pay for them. Temperature regulators for controlling the temperatures used in various tanks, ovens, etc., in process work whether they are heated by steam, gas, or electricity, or cooled by ammonia or brine, are being used more and more every day and the wise manager will not permit this source of saving to be neglected.

In order to properly heat a plant, the radiation must be ample and a good supply of steam must be available. If high pressure steam is reduced in pressure for use in heating, a steam pressure regulator or reducing valve is used. The pressure regulator costs more, but has distinct advantages in that it will maintain the reduced pressure whether a large or small amount of steam is used. The reduced pressure is not changed by reasonable change in the high pressure feeder, if a pressure regulator is used, and the reduced pressure will not build up to the high pressure if no steam is being used. In mild weather when some of the radiation may be turned off, these points are especially important.

All steam pipes, whether they be mains or coils for radiation, should be lined up in order to avoid pockets. Large pipes are often carried on adjustable wall-brackets or supported from the ceiling. By using an anchor support at one end and roller supports at all other supports up to the bends or expansion joints, the pipe can expand without danger of loosening joints. Pipe coil and cast iron radiation along the side walls should be supported by adjustable hangers fastened to the walls. In concrete walls, rails or slots or inserts imbedded in the concrete make adjustment easy. Return lines on gravity heating systems should also be lined up to avoid pockets. It is often necessary to run a return line under the floor at a doorway and unless this is properly done, it will form a water pocket. The sketch (Fig. 1) shows a method of venting return lines which must be depressed in this manner. The vapor pipe over the door should be half the size of the return pipe in order to work well. It is also suggested that tees be used at the ends of the depressed section, so that the plugs can be removed and the line cleaned out occasionally.

The packing on valves controlling steam dries up, and valves



Use Alundum Tile and Treads Wherever There is a Slipping Hazard

The first Norton Floor development was a tile consisting of Alundum abrasive grain and a vitrified clay bond. It is known as Alundum Safety Tile. The toughest of all abrasives gives this floor product longer life than any other floor material, and a non-slip surface.

Then came other developments—vitrified Alundum aggregates and marble chips using cement as the binding factor are combined to produce a great variety of color effects in both tiles and precast treads. Alundum Aggregate Tile and Treads have found a place in the finest of modern buildings in association with the most beautiful marbles and other materials. They can be produced in color combination to match the surroundings.

Where the small mosaics are preferred the slipping hazard can be eliminated by the use of Alundum Ceramic Mosaics. They are finding their place around the swimming pool, under the shower bath, in the wash room and kitchen and at the building entrance and lobby.

There is a Norton floor for every place where long life and a non-slip surface are essential.

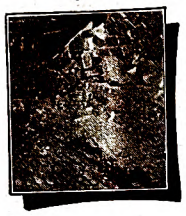
NORTON COMPANY
Worcester, Mass.
New York Chicago Detroit Philadelphia
NORTON COMPANY OF CANADA, LIMITED
Hamilton, Ontario

T-85

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Make furnace walls last longer...

— by eliminating this!



If you have fire brick linings they go bad quickly once the joints—the weak spots—give way. Bricks crack; the wall bulges; relining is necessary. Eliminate this.

— and this!

Front door arches, too, soon need repairing if made of brick. Heat attacks the joints. The joints, then the bricks, go bad after only a few months of service. This, also, can be eliminated.



— install Plibrico!



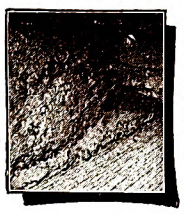
Pounded in with mallet and trowel, it forms a jointless lining that outlasts fire brick two to four times. It has no joints. Withstands 3100 deg. F. Cuts down heat loss.

— anyone can do it!

You don't need skilled masons to install Plibrico. Any man about the plant can do it. A mallet, a trowel and a desire to end furnace trouble are all that are needed.



— get walls like this!



This Plibrico wall at the Otis Bldg., Chicago, is four years old. Have you walls as old that are good for as much more service? You will have if, next time, you reline with Plibrico.

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Stocks in principal cities.

PLIBRICO FURNACE LINING

REG. U. S. PAT. OFF.

JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

Get your FREE copy

"Refractories and Furnace Design" will point the way to longer furnace life. Send the coupon for your copy.



Jointless Fire Brick Co., Ind.
1154 Clay Street, Chicago Ill'd
2-24

Send me, free, my copy.

Firm .....

Address .....

.....

Att'n .....

should be repacked at least once a year. There are on the market several packless radiator valves that make for economy of maintenance on this item. Most globe valves may be fitted with new discs when the old ones are worn and re-seating machines are used when the seat is not tight. Another type of re-seating machine is used on gate-valves. On small and medium sized lines screwed unions with a metal seat are generally used. On the larger sizes, flanges with gaskets are used.

A great deal of steam is carelessly wasted by using traps which do not work right or by not using traps at all. Radiator traps are different for the various systems and should be carefully chosen to fit in with the rest of the return line equipment. Some systems use return traps delivering to a direct return trap that puts the water back into the boiler. Condensation pumps are used where the return pipes are at about the level of the boiler water and can often be used to make an otherwise sluggish system work. Vacuum pumps by producing a pressure less than atmospheric pressure in the return lines will draw the condensation back to a hot well.

From the standpoint of economical maintenance, the savings which can be effected by the judicious use of pipe covering, are everywhere apparent. A direct saving in fuel will repay the investment for insulation of pipes and other heated surfaces in a short time. The only reason that some of these losses are allowed to continue is the fact that the management does not realize how great they are. The question of the advisability of insulating must be determined by the engineers after a thorough study of conditions. For low pressure steam lines and hot water lines, a rather low-priced insulation, such as an air cell asbestos covering, is often used. The selection of the type of material to be used can only be made after all considerations have been carefully weighed. These include items such as initial investment compared with the saving made, permanence of the job, etc. There is a point in insulating expense, where the possible savings are not commensurate with the outlay and the money spent on better or thicker insulation will not be well invested. However, this point is rarely reached in plant work.



At Your Service

INVENTORS and builders of small motor driven tools and machines—confronted with perplexing power problems—are invited to take advantage of the services of our Engineering Department.

This department has for many years been in close contact with the uses and application of small motors. Their experience is offered to you as a help in the working out of your own problems.

We will gladly co-operate with you in the building of a *better* product. Do not hesitate to call on us for advice. Our combined efforts will, perhaps, result in another appliance being made more saleable and more dependable because it is equipped with a motor that is exactly adapted to its particular job.

Wisconsin Electric Company
7067 Sixteenth St., Racine, Wis.

DUMORE

FRACTIONAL H.P. MOTORS



Type-A—Stripped
¼ h. p. Cast iron frame, enamel finish. Babbitt bearings, wick oil feed. Operates on A.C. & D.C.



Type-D
⅛ h.p. Cast iron frame. Enamel finish. Plain bearings. Grease cups. Operates on A.C. & D.C.



No. 3GM—Stripped
¼ h.p. Aluminum frame, enamel finish. Normal bearings. Ventilated. Operates on A.C. & D.C.



Type-SAX
Motor 1/25 h. p. Special base.

ELEVEYOR



The ELEVEYOR (3 Trucks in 1) Saves 66⅔% in Handling Costs at this Plant



Write for Catalog

Here is another example of how the ELEVEYOR—the Truck that conveys, elevates and stacks material—saves in handling and storing costs.

In this plant (name on request) the ELEVEYOR has not only effected savings in the storing of raw materials, but has actually cut handling costs 66 2/3%.

We have a practical plan whereby we can prove the economy of ELEVEYOR Trucks, right in your own plant. Let us tell you about it.

ELEVEYOR INDUSTRIAL TRUCK CORP.
56 Huntington Street Brooklyn, N. Y.

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One usually finds not enough insulation rather than too much. The laminated or air cell asbestos coverings are not recommended for temperatures above 400° F.

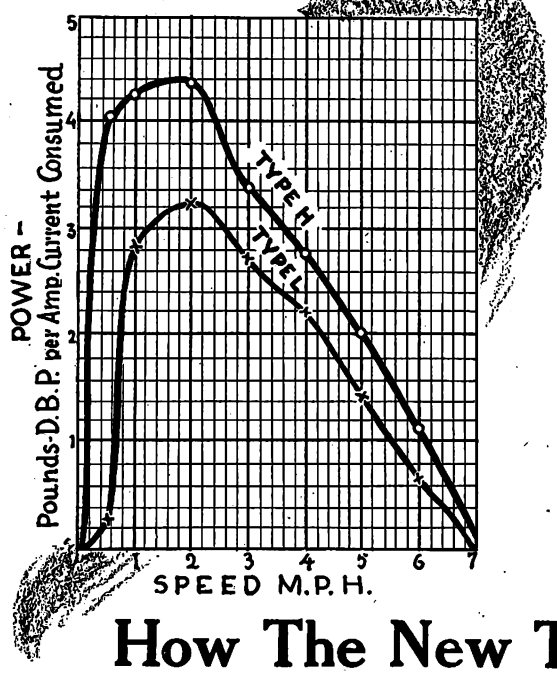
For main steam lines eighty-five per cent. magnesia is recommended. This is made up of eighty-five per cent. of magnesia and fifteen per cent. of asbestos fibre, as this proportion has proved best by experience. This covering is used in most power plants on main steam lines because it is universally considered the best insulation for this work. It is very efficient and is strong and light in weight. It is used on temperatures up to 750° F., above this point a high temperature insulation is used.

In order to prevent damage to machinery or goods in process, due to condensation dripping from cold water pipes, a wool felt covering is recommended. Outdoor water pipes, such as exposed pipes down from sprinkler tanks, should be protected with several layers of hair felt, the number depending on the severity of the climate. Usually a layer of tar paper and three layers each of hair felt and builders' paper are used with a jacket of canvas sewed on outside. On outdoor steam and hot water lines, the thickness of the usual covering should be increased and a layer of waterproof paper applied. The canvas jacket should be painted with a coat of sizing and two coats of oil or asphalt paint. Underground steam and hot water pipes require special protection. Oftentimes the expense of a pipe tunnel is not justified and the pipes must be laid in the ground. If the ground is wet, a drain should be laid with loose rock around it about a foot below the grade of the pipes to be insulated. Several systems of underground insulation are available, the main items to be taken care of are roller supports for expansion and waterproofing and protecting the heat insulating covering. One system makes use of a tile-protecting member that is filled with insulating material. Brine and ammonia lines are insulated with cork covering two or three inches thick or with built-up felt consisting of several layers of felt sealed with asphalt. The sealing is important so that moisture will not accumulate between the pipe and covering and freeze there, causing the covering to break.

Most modern plants are equipped with an automatic sprinkler system. However, there are frequently portions of old plants not so protected. The cost of this protection is quickly repaid by reductions in insurance premiums and it is therefore poor business policy to have unsprinklered buildings. It is quite important that the correct sprinkler heads be used in places subjected to high temperatures in the normal manufacturing process. It is necessary to get authority to use these high temperature heads, but they should be used in furnace rooms and other hot rooms to avoid danger and damage that might be caused by a head letting go not due to a fire. There is also the danger of freezing in monitors and other places exposed to the cold. Oftentimes authority can be obtained from the insurance company to shut off sprinkler lines in monitors during the winter. For unheated spaces, like sheds and pattern storage rooms, a dry pipe system is recommended. In this system a

(*Continued on page* 65)

Specify the Tractor with Reserve Power



THE new Mercury Type-H electric tractor has 25% to 40% greater power for a given speed and current consumption than the best of the worm driven models. See the graphic illustration of this big advantage in the accompanying curves. We have the complete data to back up these curves.

This reserve capacity enables the new tractor to pick up extra trailers when needed, to pull up a steep grade that would balk an ordinary tractor, or to work overtime without exhausting the battery. This naturally results in lower operating cost.

Any machine will operate more economically if it is not being continuously pushed to the limit of its capacity. The reserve power in the Type-H therefore means not only lower operating cost but also reduced maintenance expense and increased dependability.

How The New Type-H Makes This Possible

Introduces a balanced internal gear drive of entirely new design, eliminating the friction losses inherent in the worm drive. This results both in low operating cost and an absolute minimum of upkeep for the "power plant."

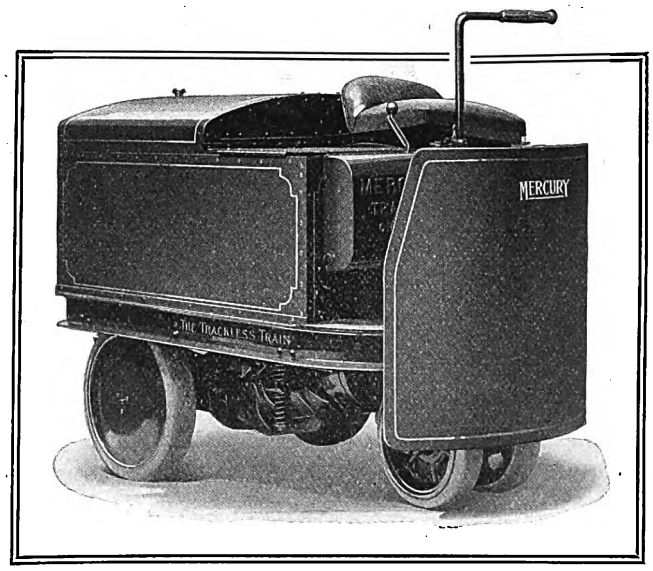
Retains all valuable features developed in previous Mercury models including:

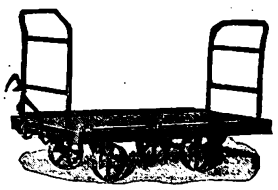
1. Special safety features effectively insuring against danger, even in the hands of inexperienced workmen.
2. Drum type controller of special design having long life, dependability, simplicity, ease of inspection and adjustment.
3. The exclusive Twin-3 front wheel assembly combining full spring suspension with the short turning radius of older 3-wheel models.
4. Frame of channels and angles hot riveted to combine maximum simplicity, rigidity and strength.

Fleet Owners

The Mercury organization pioneered in the field of electric industrial tractors, and for more than 8 years has made such tractors and trailers exclusively. It is therefore not surprising that a preponderance of all the large installations are 100% Mercury. A few of the large fleet users (over 10 machines) are the following:

American Railway Express Co.
American Radiator Co.
Armour & Co.
American Window Glass Co.
General Electric Co.
Endicott-Johnson Co.
United States Government
Studebaker Corporation
Sugimure Warehouse (Japan)
Willys-Overland Co.
American Car & Foundry Co.
Kewanee Boiler Co.
Eastman, Gardiner Lumber Co.
Standard Oil Co.
Union Stock Yards & Transit Co.
Pennsylvania Railroad Co.
Sears, Roebuck & Co.
Illinois Central Railroad
Lehon Co.
Morris & Co.
Swift & Co.
Miller Rubber Co.
Chicago Tunnel Co.
Chicago Union Station Co.
Chicago Burlington & Quincy R.R.
New York Central System





Trailers

And to complete the "Trackless Train" there are Mercury trailers of just as distinctive merit as the tractor. There are various designs for special purposes, but the A-310, illustrated above, is an all-purpose trailer which meets most all ordinary industrial conditions.

Mercury Manufacturing Company

4112 South Halsted Street — *Chicago, U. S. A.*

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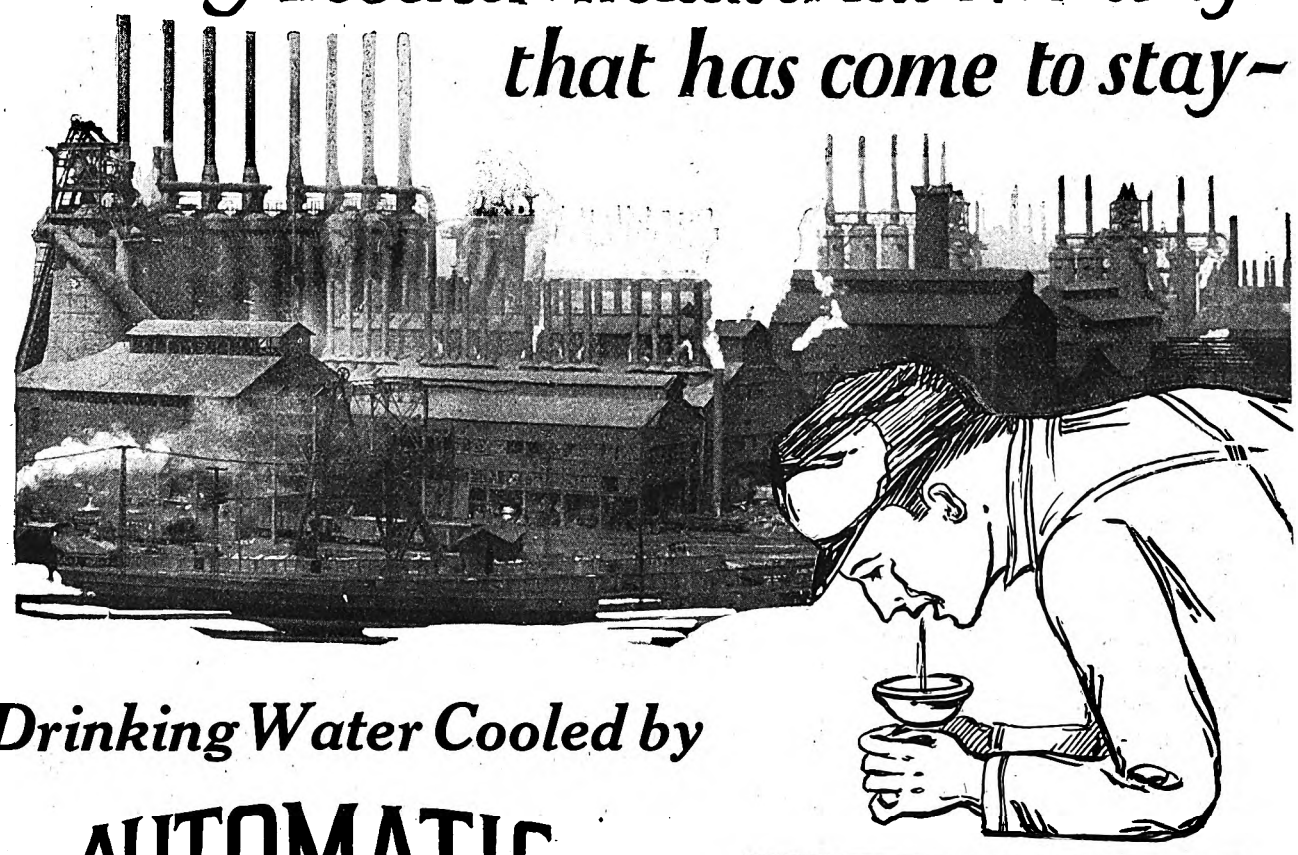
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(*Continued from page* 63)

rge special valve is necessary. his valve admits water to the nes as soon as a head goes off. alves on sprinkler lines should sealed open or shut as indited and it is a good idea to ve enameled signs at each lve listing the rooms or buildgs it controls. These signs ould also be hung on the indi-tor posts in the factory yard. ydrants should be located at rategic places, such as junc-ons of two roads, so that hose n be carried in several direc-ons. A minimum amount of se should be coupled to the drant and be carefully coiled folded so as to be easily lled out without tangling. The drant houses should contain l the necessary fittings, renches, lanterns, nozzles, etc., all times. All underground rinkler pipes should be of cast on, with joints of lead, well ulked. They should be buried the ground at least six feet cold climates and hydrants d indicator posts should be ng enough to be set at the cor-ct height above ground. It is ecessary to have an elevated nk of a capacity large enough take care of a fire lasting sev-al minutes or else have an-her source of supply besides e city service, such as a river pond or artificial tank with nnections to a fire pump. prinkler tanks are of the plain ravity or pressure types, some-mes both are used. With the ressure system air pressure is plied above the water level in osed tanks. All tanks exposed cold should be heated by eam coils inside the tank. hese are usually placed inside e tank near the bottom and ear the sides of the tank. The eam riser and return should e run alongside the discharge ipe and be insulated as previ-usly mentioned. It often hap-ens that a small fire during the ight causes more damage by ater than by fire unless the ater is shut off after the fire. f watchmen are not available, is service can be had in most f the large cities. These patrol ervices get the electric alarm their office when a sprinkler ead goes off as this reduces the ressure on the system and they nd men to cover up merchan-ise and machinery, shut off the ater when the fire is out and ut in new heads and turn on the ater again. With a trained rew of night watchmen, this me work can be done.

Much that has been said above regarding steam pipes, valves, and fittings applies equally as well to air, gas, oil, water, and drain pipes. Hydraulic and ammonia lines require special fittings and extreme care in making up the joints. Elbows on hydraulic pipes should be braced to reduce vibration caused by quick changes in pressure. Leaks of any kind should not be tolerated. Besides the direct loss of the leak itself, there is the damage to goods and equipment as well as depressed morale of employees if they feel that the management does not seem to care about things of this kind. For packing flanged joints, the correct packing for the particular service should be used. If the responsibility for leaks is put up to the pipe-fitter foreman, it will in time have its effect by his insisting on first class work from his men. The most frequent leaks in a plant are in the compressed air lines because the men mistreat the valves. Spring valve nozzles are now used almost exclusively to reduce leaks, but the average

Another Industrial Necessity that has come to stay~



Drinking Water Cooled by

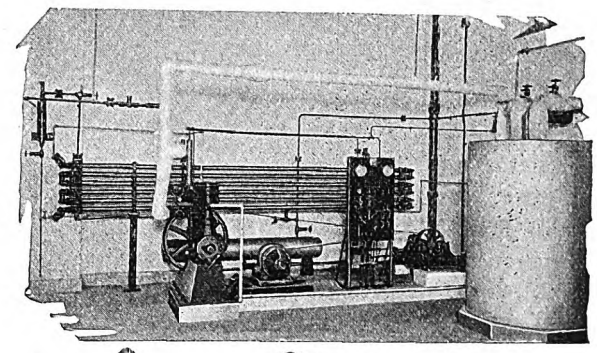
AUTOMATIC REFRIGERATION

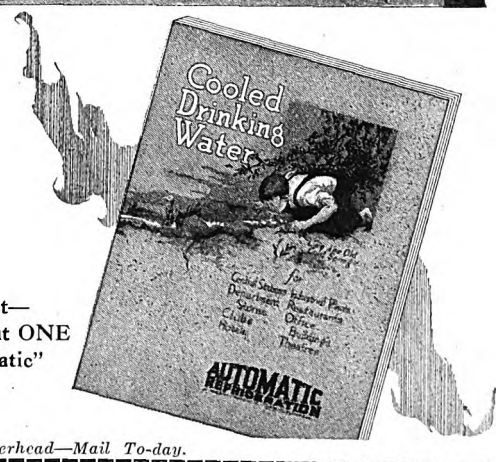
Industrial executives have been quick to recognize the many good will building—money saving features of Automatic Refrigeration as in the Carnegie Steel Works shown above. In many well-known industrial plants production has increased and sickness lessened since automatic refrigeration was installed.

The refrigerating system was found to be far cheaper than cooling with ice; and also, with Automatic Refrigeration, the lost time of employees decreased to an amazing extent.

It cost one mill $5,000 a year to use the old-fashioned ice cooler method before they installed mechanical refrigeration. Now they have a permanent method of distributing properly cooled water at a saving of $3,000 a year.

In order that the industrial executive can learn first hand all about the investment features of Automatic Refrigeration, we have printed this attractive brochure which will be sent to you on request.





A Fact—
There is but ONE
"Automatic"

The Automatic Refrigerating Co.

Home Office and Works: Hartford, Conn.

Branch Sales and Service Office in Many Cities

Clip to Letterhead—Mail To-day.

To The Automatic Refrigerating Co.
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TRADE JENKINS MARK
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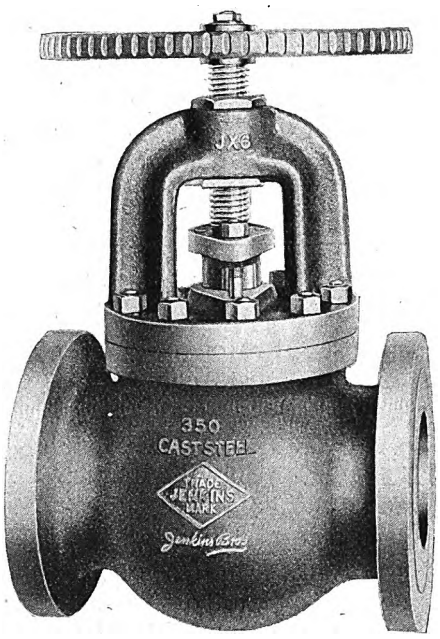


Fig. 380, flanged, Extra Heavy Cast Steel Globe Valve.

For high pressure superheated steam

Great care is maintained throughout the manufacture of Jenkins Extra Heavy Cast Steel Valves for high pressure and superheated steam service.

Every detail of design has been thoroughly considered, only the best materials are used, and throughout the manufacture great pains are taken to produce absolutely flawless valves. Experience has ***proved*** that these valves are perfectly adapted for the severe conditions incident to high pressure superheated steam service.

Bodies and bonnets are of cast steel, and the spindles, seat rings, discs, and disc rings are of Monel metal, which is non-corrosive and which expands and contracts practically the same as cast steel.

These valves — likewise all Jenkins Valves—you can install with assurance of long years of dependable performance. They are safe and permanent and economical.

Valves in bronze, iron, and steel for all power plant requirements.

JENKINS BROS.

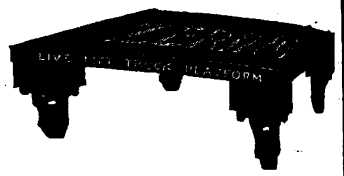
80 White Street.....New York
524 Atlantic Avenue.....Boston
133 N. Seventh Street..Philadelphia
546 Washington Blvd.....Chicago

Always marked with the "Diamond"
Jenkins Valves
SINCE 1864

employee thinks that air is cheap and an educational campaign is necessary to make him realize the cost of compressed air. Gauges and thermometers on pipe lines and tanks should be located so that they are not apt to be hit or broken off, they are indispensable and they should be accurate and dependable. Pipes for vacuum cleaning systems should have tight connections which can be plugged into. These are usually brought out near the floor line. Steam for process work and for such heating jobs as soda kettles, metal washing machines, etc., should be on separate lines from the heating system so that only the small pipes necessary for this work need be used in summer. Plating rooms also should have their cleaning tanks heated from special supply pipes. For heating jacketed kettles or open tanks, where a high rate of heat transfer is required at temperatures above those of saturated steam, a heated circulating oil system is often used. In this system the heavy oil is circulated by a pump through a heat absorber and then to the tank to be heated. Temperatures up to 600° F. may be used with heavy oil. When a number of pipes are run underground from one building to another, a pipe tunnel is desirable. Pipes may be hung on brackets on both walls and from the ceiling, if necessary. The tunnel should be waterproof and large enough to allow a man to walk through. Pipes buried in the ground are hard to get at if something goes wrong and the tunnel is therefore almost a necessity if important pipes are carried in it. If only a few small pipes are needed a hardwood box of rough lumber about twelve inches square can be made with a loose cover, and if its location is charted, it can easily be found when necessary.

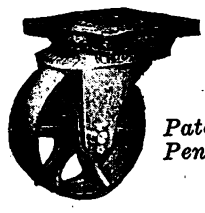
The work of the plumbers is very closely allied with the pipefitters, and in plant work it is not uncommon to have men who are able to do both jobs. The sanitation of the toilet rooms is so important that every effort should be made to keep them in repair. Toilet bowls that are cracked or chipped are breeders of disease and should be replaced at once. The urinals that are considered best are the high porcelain stalls and they are fast superseding the small urinals just as the individual toilet bowls have made practically ob-

No Wasted Time with this Live Platform



Your weekly payroll buys time in the form of labor. Every minute wasted in your plant decreases production and profits. "Dead" platforms are a direct source of loss. They promote idling and inefficiency for they cannot be moved without the aid of a lift truck which is usually in use somewhere else.

Zering Live Platforms



Patent Pending

Champion Adjustable Double Race Casters

These patented double race casters are standard equipment upon all Zering Live Platforms. They are trouble-proof and do not stick. All wear in the ball races is easily taken up by an adjusting nut without removing the casters from the truck.

Save thousands upon thousands of minutes that mean money. Moving on ball bearing, swivel casters they carry raw materials and work in progress from machine to machine without loss of time or extra lift truck equipment. They pay for themselves rapidly in the countless yet absolutely necessary short hauls which eat up time in every plant.

They are built to last, to stand up under hard usage. There is a Zering Live Platform for practically every class of material, in sizes to suit every requirement. You'll wonder at their low cost once you have examined their construction.

THE H. ZERING MFG. COMPANY
4425 Enyart St., Oakley Station,
Cincinnati, Ohio

Manufacturers of Trucks, Trailers, Casters and Skids

Indicating **Tycos** Temperature Instruments Controlling
Recording

Tycos Recording Thermometers



"At present we have 6 Tycos Recording Instruments—two on the superheated steam run which show and record the difference between the power house and the distant point where the steam is used. One on the blow-off valve, which indicates leaking and faulty valves or cocks on the entire battery of boilers, and three on our refining process. The one on the blow-off valve aids us in the efficient operation of our boiler room, insuring the utmost economy."

This is part of a letter from the General Superintendent of a large Chicago concern. Write for Power Plant literature.

Taylor Instrument Companies
Rochester, N. Y., U. S. A.

Canadian Plant: *Tycos* Bldg., 110 Church St., Toronto

There's a *Tycos* or *Taylor* Temperature Instrument for every purpose

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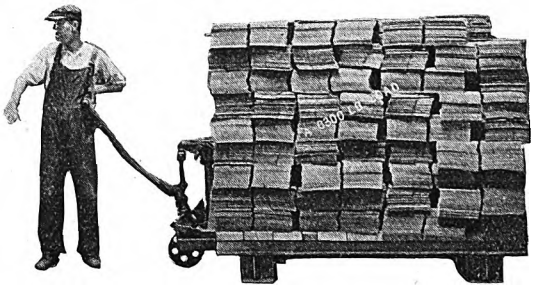
ete the old range closets. The ire for individual toilet accommodations is shown by the ividual wash bowls, which coming more and more into . In some plants each worker s his own wash bowl. The g double wash sinks with acets in the center accommote a great many more men for same investment and the wer round wash fountains also ommodate a great number of n. Both of these give each n clean running water and are refore sanitary. In places e foundries, where the men very dirty, shower baths ould be provided. A hot water ater, with a thermostatic conol or a hot water mixer, is cessary for shower baths. bblers or drinking fountains ould be installed in every om. These may be of the wall floor type. If they are iced, e floor type is used. If reigeration is available, circuing iced water will do away th the labor needed to ice the plers once or twice a day. ain pipes inside the building ould be of cast iron with ints of lead and well caulked. tside of the building underound they may be of tile. ese drain and sewer lines are ry important and should be id to grade so as not to pocket y water.

Mechanical ventilation is gradlly being used more and more industrial plants. It has been ed for a long time for drawing t poisonous fumes and dust, t it is gradually being realized at fresh air is worth money by moving the tendency toward owsiness, which the men have badly ventilated rooms. The ual ventilating systems clean e incoming air by washing, midify and heat it and deliver ean tempered air for the men breathe. This washing and midifying is done by water ts, the usual method being to ash the air first, then heating to the desired temperature. ir at high temperatures will arry more moisture than at low mperatures. It is quite obvius that the air can be pretty ell saturated at low temperares and then heated and at the igher temperature have less midity. In this way it is posible to control the humidity. In rder to obtain the best ventilatng effect, the air supply should e large in volume and comparaively low in temperature. This equires larger fans to move the rger volume of air, but it has been proved by experiment that this way is much better than using a small volume of highly heated air. The advantages of heating by the indirect or ventilating method naturally cost more in the initial investment, but in order to get real ventilation a mechanical system is necessary. A lower temperature can be maintained if the humidity is increased and in this way it may be said that humidifying pays on savings in fuel. This humidity should be kept within the limits mentioned in order to be comfortable. Too much humidity produces a sticky feeling and is apt to make the men feel drowsy. The method of washing, humidifying, and heating the air is called air conditioning and this term very well describes it. These systems often have arrangements to recirculate some or all of the heated air, especially during the warming up process in the morning. The air ducts are usually carried along the ceiling near columns or walls with outlets at convenient locations. These ducts interfere with other equipment, such as shaft-



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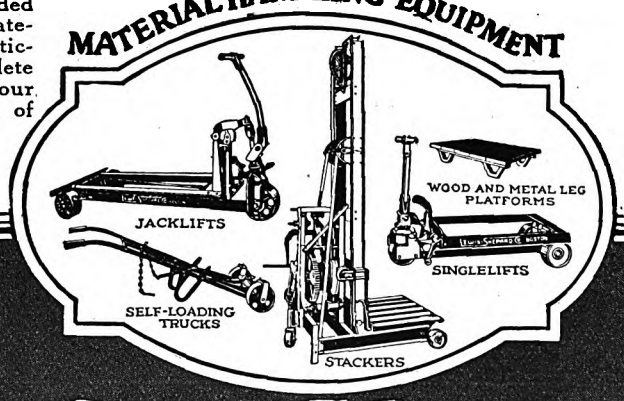


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ing, etc., and in new concrete buildings hollow columns are sometimes used as ducts. Usually the outlets are made Y-shaped in order to reduce the velocity of the air by doubling the size of the outlet suddenly. This should slow the velocity of the air so that the employees working near the outlets will not feel any breeze from them. Sometimes large main ducts are built of concrete under the floors and these should be kept dry. They will also absorb some heat during the warming up period. Ducts should be of a sufficient thickness galvanized iron to hold their shape and they should be securely fastened. Dampers should be provided so that even distribution may be had. Very little maintenance work by the tinsmiths should be necessary on the ducts.

Exhaust systems are required by most states on polishing, woodworking, and sand-blasting equipment, and a minimum suction at the hoods is usually specified. The hoods on polishing wheels should have a trap at the bottom for cleaning out heavy particles falling down when emery wheels are used. The piping should be correctly designed in order to give an even suction all over. The dust collectors are often on the roof and should have a cleanout can at the bottom so that they can be cleaned out every day while the system is working. The systems used for woodworking machinery should be capable of handling the sawdust and shavings produced. As the modern machines produce more shavings than formerly, the exhaust systems will have to be changed to take care of the increase. The wear and tear on these systems is much less than on polishing or sand-blast systems, where elbows wear out and have to be renewed. The lining in the dust collectors can be renewed and if this is taken care of, they will last a long time. These pneumatic systems are also used for conveying materials and this method of handling is very economical. Ventilators of the suction type are used on roofs for drawing out air, dust, and fumes. These require no power to operate them and a slight breeze is enough to make them pull.

The tinsmiths usually make the guards for the machinery. These are usually built on heavy wire or angle iron frames with wire or expanded metal as protection. These guards may be made to conform to insurance companies' specifications and thereby gain a small reduction in the premiums, or they can be made to guard against the average accident. Gear guards on machines are sometimes made solid of galvanized iron as they can be fitted closer to the machine. Splash pans for machines using lubricants are usually made of galvanized or black iron. They should be carefully made and should not interfere with the operator. Outside leaders and gutters and tin roofs are in need of continual care by the tinsmiths and they should not be neglected.

In the pipefitting shop, there should be power-driven pipe cutting and threading machines and a complete set of pipe dies and small tools. Supplies should be drawn from the maintenance stockroom as needed and small amounts only kept on hand. There should be steel pipe racks at a convenient place and small bins should be provided for the few fittings carried. There should also be a motor or gas engine driven pump, mounted on

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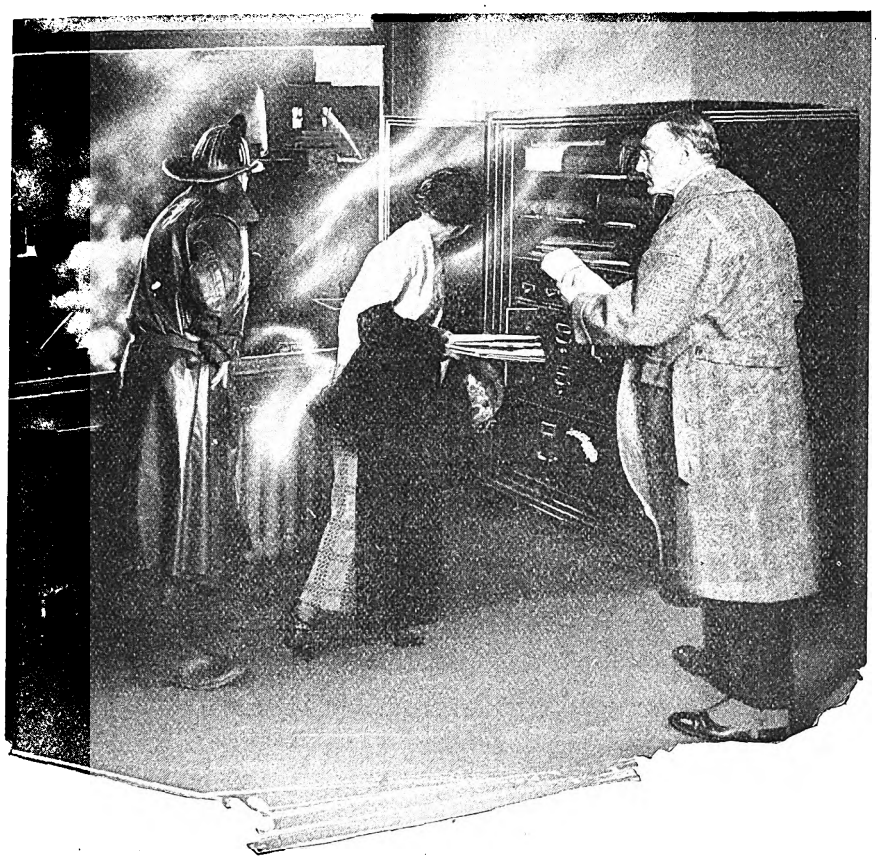
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a truck, for pumping out pits or basements in case of a leak or heavy rain causing water to back up.

It is very important that there be maps of all piping, especially underground piping. Records should be made of all changes, repairs, and replacements and the maps kept up-to-date. An inspection system is necessary and these reports together with the records of repairs give valuable data for future use.

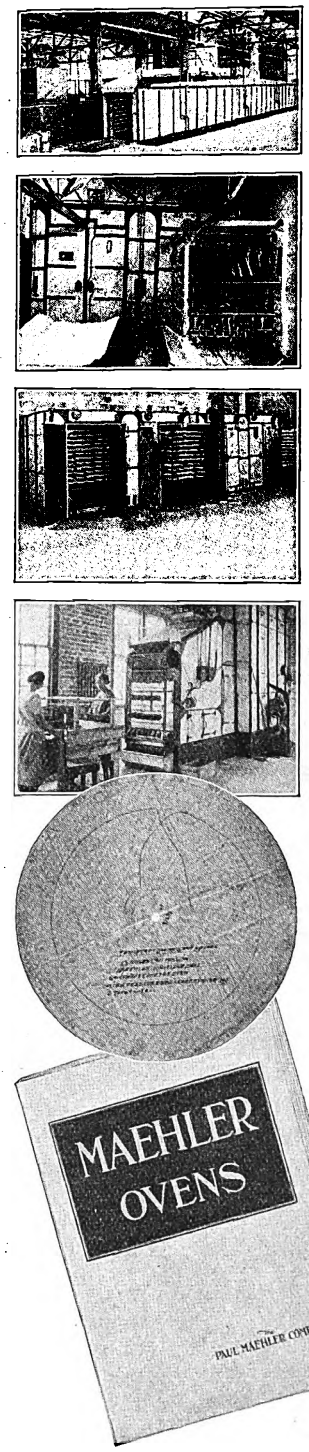
There has recently come in from the four corners of the United States the story of general business conditions, told by those who are on the spot and know whereof they speak. The dominant note is that of a sound and healthy conservatism which seeks to see more clearly before it ventures far into a somewhat uncertain future. Only occasionally is there alarm or pessimism manifested, and then it is invariably the result of poor local conditions.

Throughout the country there is everywhere a growing sense of obligation and responsibility on the part of common people for the welfare of the nation. The great mass of the people have not lost their grip, even though some superficial observers may say that they are dragging their anchors.

Some business men are inclined to be a bit pessimistic over the fact that 1924 is a Presidential election year. They entertain a loose traditional idea that all such years are naturally bad for business. This year, however, there already are some indications that the sentiment of the country in general is tending to crystallize into definite expectations concerning the outcome of both the nominating conventions next summer and the election returns next fall. It appears now, therefore, that this element of uncertainty in the general situation during 1924 will be less of a major factor in shaping business conditions during the year than it has been in some other election years. There is no doubt, however, that uncertainty as to the outcome of the election will be sufficient to have some influence in maintaining the conservatism that has characterized business as a whole during the past half year or so. —*La Salle Extension Bulletin.*

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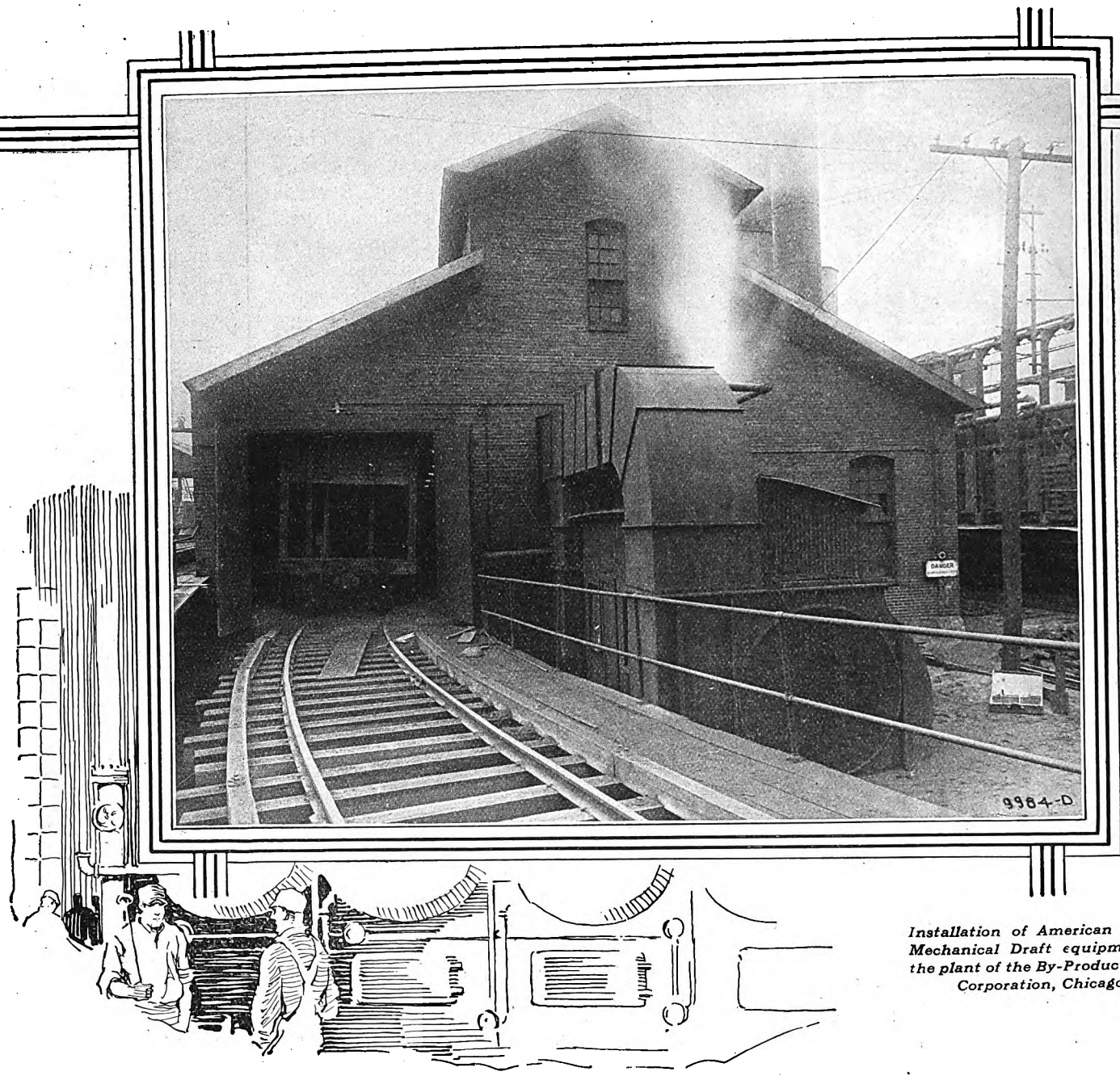
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To get the same capacity with natural draft, we would have to burn coal, which costs $3.50 a ton more than fine coke breeze. Therefore, the American Blower system saves $88,200 a year in fuel cost. It also saved the cost of the higher stacks which would probably have been required to create satisfactory natural draft.

We are also using 4 American Blower fans for handling hot gases from our coke ovens. This enables us to generate 1000 boiler horse power for every pair of fans.

The American Blower equipment was chosen because we were convinced that it would give good service. It has been very satisfactory and we have experienced no mechanical troubles. Under similar conditions we would repeat our orders.

The manufacturers furnish first class service, a highly important consideration in the choice of any equipment."

Bulletins describing American Blower Equipment will be mailed upon request.

AMERICAN BLOWER COMPANY, DETROIT
BRANCHES IN ALL PRINCIPAL CITIES
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"Sirocco" TRADE MARK

EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES

FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

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Planning the New Factory Building

(*Continued from page* 13)

ion of one process to the next will not be very close. For instance, in our pencil factory, he woodworking machinery will ave little relation to the graphte preparing equipment, or to he ferrule and eraser units. All f them, however, come together n the assembly unit. These disinct groups become departnents, and may occupy separate ections of a one-story building, eparate floors in a multistory uilding, or even separate structures.

Suppose our hypothetical penil plant requires around 5,000 quare feet in our woodworking lepartment, 3,000 feet in the graphite department, 2,000 feet n the ferrule department, 2,500 eet in the rubber department, 2,500 feet in the assembly room, nd 5,000 feet for general storge, shipping, and offices. This vould suggest a four-story buildng of 5,000 feet to a floor, one or woodworking, another for graphite and ferrules, a third for rubber preparation and final assembly, and the last for storage, shipping, and administration. Thus the general arrangement of he plant begins to shape itself, modified, of course, by other factors, such as the area and value of the available land, the need for light, and the special requirements of unusual machinery or process equipment.

Where land values are low, he choice of a one-story as compared with a multistory building, will have to be made with care. The high building needs stairs, elevators, and fire-escapes that are non-productive. The one-story building requires more roof and foundation wall, but under some circumstances may actually cost less per productive square foot of floor space. High land values, of course, indicate multistory structures.

Consideration should be given at this stage to the question of a standard type versus a special kind of building. By standard type we simply refer to a building of such character as to make it suitable for other industries, in case it became necessary to sell the property or convert it to other uses. Normal floor loads, normal ceiling heights, and normal column spacings, make a building more readily marketed if a change should become necessary, and consequently increase its sales value. On the other hand it is quite possible that the requirements of the business for which the structure is first planned are best met by major deviations from such normal or average dimensions and strengths. The ultimate advantages of the standard versus the special should be carefully weighed, and a decision reached as to which is likely to be the most profitable.

In a case recently under the writer's control, an automobile body plant making steel bodies had machines in certain departments requiring much greater ceiling heights than the machines used in other departments. Balancing the need for special space requirements against the advantages of convertibility, resulted in designing the six story concrete building with a different ceiling height for almost every story, the extremes being approximately 21 feet from floor to floor in one instance and a normal 14 feet in the minimum floor.

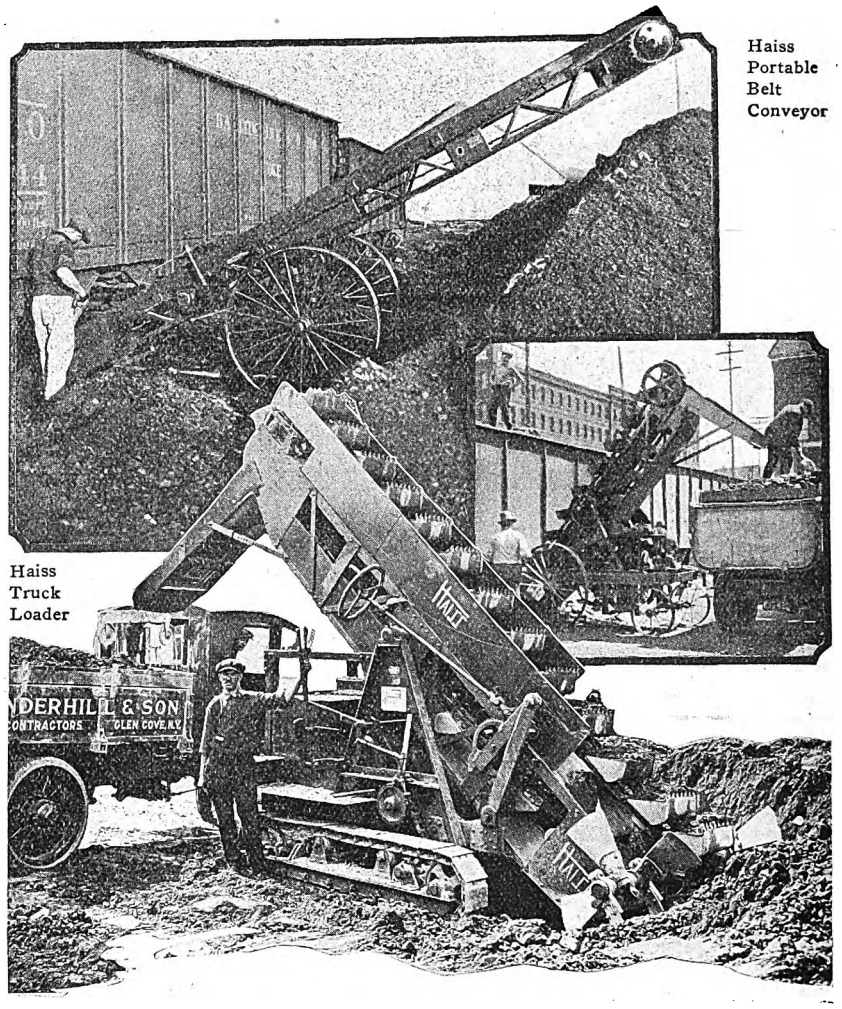
Now we come to the detailed planning of the building. All important matters of policy and arrangement have been settled, "in principle" at least. It is generally wise not to establish the requirements too rigidly, as some deviations from the ideal may prove entirely practical and at the same time effect important economies in construction. Up to this point the owner and his staff have been working (or should have been working) in close coöperation with their chosen architect and engineer and his staff. Each has knowledge required to discover and analyze the facts needed in establishing these matters of policy and general arrangement. Either group working alone would in all probability find itself guessing at important matters that the other could establish with sound judgment. Either working alone would produce an incomplete conception, and the resulting structure would ultimately show errors and omissions likely to be distressing and costly.

Now, however, the architect and engineer (using the two terms together to indicate a coordinated staff of men trained in all the branches of each profession) can work out most of the remaining details. Nevertheless, to carry the whole process through to the end, we will continue this analysis to show

(*Continued on page* 73)

Stop Shoveling

WHERE you used to pay dollars for hand shovelling you can do the same work for dimes with a Haiss Portable Belt Conveyor or Truck Loader. It's the economy way to stack and reclaim Coal from ground storage. And the equipment is flexible—you can use it anywhere for any other handling job.



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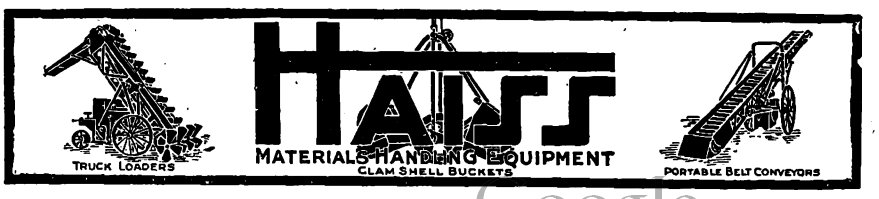
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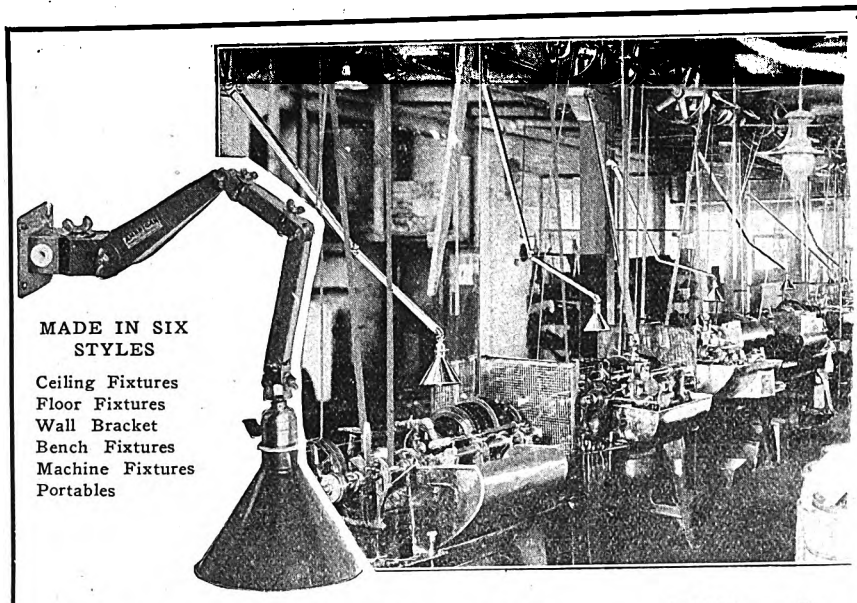
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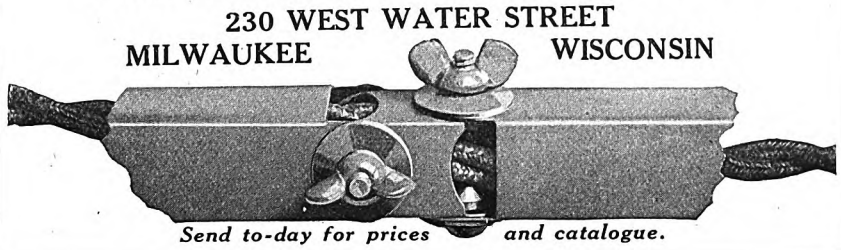
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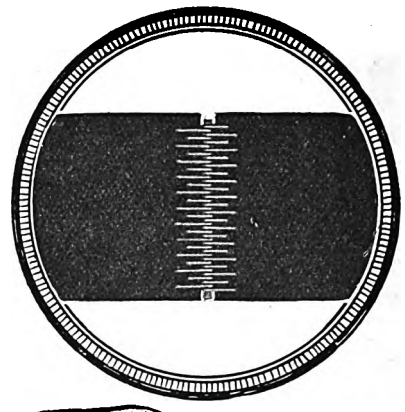
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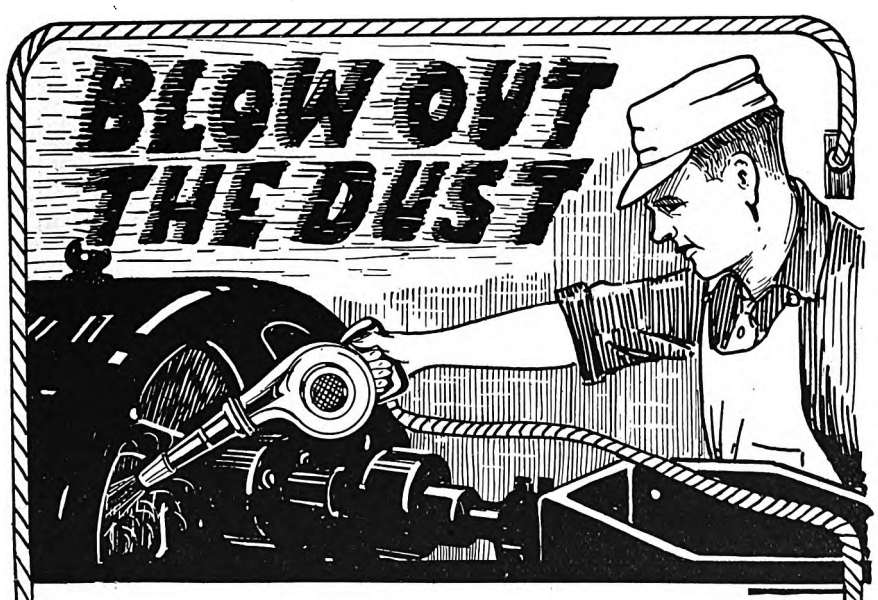
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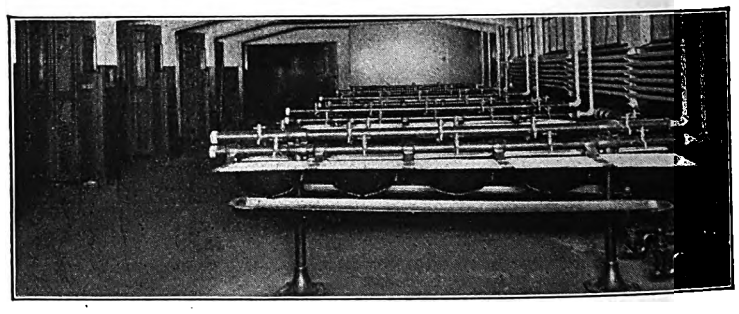
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Weighs only 6 lbs. Complete in itself and requires no expensive installation or equipment. No condensation as with compressed air. Attached to any light socket.

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Were designed especially for factories to provide a sanitary, efficient washing-up apparatus at a moderate cost. They have displaced the open sink, the common trough and other unsanitary methods of washing-up and have been pronounced by many authorities the ideal factory washbowl, whether the plant employs 50 or 5,000 men. They are ruggedly built, simple in construction, easy to install and eliminate high plumbing expense. They are space-savers and take up no more room than common sinks.

A few of the prominent firms who are large users of MEECO Individual Sanitary Washbowls:—Amoskeag Mfg. Co., 1000; Bethlehem Shipbuilding Co. (Fore River Works), 1000; Central of Georgia R. R., 1000; Colt's Patent Fire Arms Mfg. Co., 3200; General Fire Extinguisher Co., 1200; New Departure Mfg. Co., 1600; Pratt & Whitney Co., 2800; Underwood Typewriter Co., 1000; United Shoe Machinery Co., 2400. The complete list of firms using MEECO Washbowls reads like the Blue Book of American business. 5000 companies in 200 lines of business have adopted them as washroom equipment.

They Are Really Sanitary

There is room enough at each bowl for every man to get a thorough, clean wash without crowding. The unsanitary and inefficient features of washing in a running stream are here obviated. There is no slopping over on other men. There are no half-way attempts to get clean. There is no waste of water. Let your men put the plug in, fill the bowl and clean off the grease and grime. They can't do it in a running stream.

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(*Continued from page 71*)

how these data are used to develop the final plans and elevations from which the building will be erected.

Heretofore we have not mentioned the choice of structural materials for the building. Although this aspect of the problem is likely to be one of the first things considered by the owner when he starts thinking of new buildings, it is really a matter to be determined after all the other factors are known. In fact, the choice of construction could be left entirely to the architect and engineer, for it is their business to know what materials and methods will best meet the established conditions. Of course where the choice between several materials is optional, the owner's preference should govern; but if the owner fixes in advance the type of construction it may hamper the development of the most effective structure for the purposes in hand.

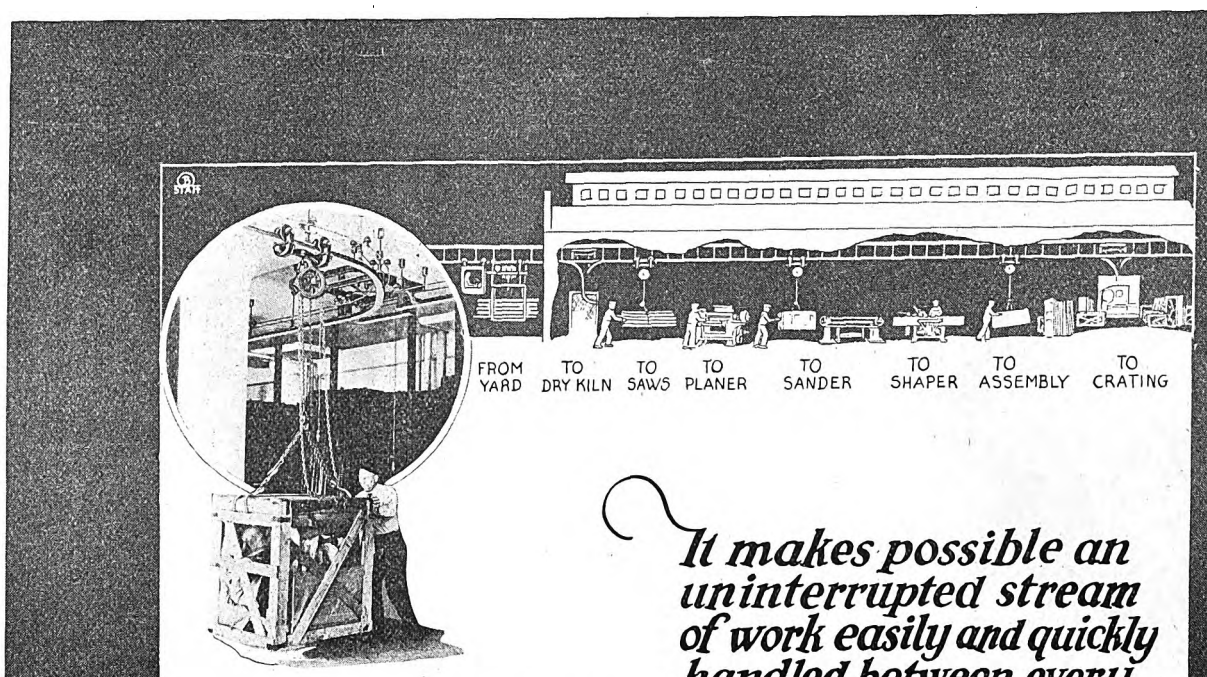
Assuming the choice is unrestricted, it will be found that the demands of the manufacturing process will indicate the materials most suitable for the building. For instance, while concrete may be the logical material from the point of view of permanence and fire-resistance, if the process be one that requires many apertures in the floors for piping, material conveyors, or for parts of the machines, it may be much better to use the old type "heavy mill" construction with wood plank floors, because such floors can be penetrated almost at will without much expense and large openings may be reframed as required. A paint and varnish plant for example, is one that finds a wood plank floor valuable for this reason, for many of the processes are connected by elaborate piping systems passing from floor to floor. If the building had concrete floors the rearrangement of the machinery when enlargements were made would entail great expense in cutting holes of various sizes from one floor to the next, for the reinforcing steel might be severed and the whole slab weakened.

The choice of brick walls as compared with concrete or hollow tile is governed largely by cost and appearance. Unprotected steel framing may be used safely in some structures, but in others would entail a great loss in the event of fire. So it goes with each material; there is a purpose and a place where one substance is superior to all others, and it is the designer's business to choose and use each one correctly.

To be more specific we may briefly outline the advantages and disadvantages of the principal types of construction. From this outline it will be clearly apparent that the choice of construction is governed largely by the purpose for which the building will be used.

Heavy mill construction uses large dimensioned wooden beams and girders with a wooden floor made of planks generally 3" or more in thickness. Sometimes the columns are steel and occasionally some of the girders are of steel, but frequently wood is used throughout except for the walls. These may be of any material, such as brick, hollow tile or concrete.

This construction is called "slow burning" because the heavy wood members do not take fire quickly. Such buildings possess the following advantages: They are relatively



From rough lumber storage through every department and to every machine in the mill—even to the loading of finished material on to trucks or cars—***the Cleveland Tramrail can be arranged to save thousands of dollars yearly in material handling costs.***

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It makes possible an uninterrupted stream of work easily and quickly handled between every operation in the Wood Working Shop

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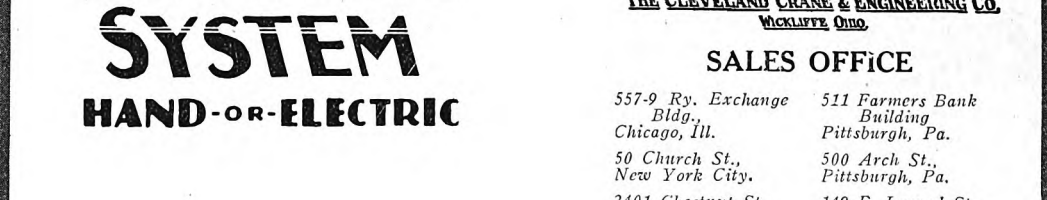
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THERE IS NO LET UP IN PRODUCTION BETWEEN MACHINES

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inexpensive, easy to construct and easy to alter, reasonably fire resistent, and in the event of a fire the members are not likely to collapse until fairly well burned through. For industries using chemicals or materials creating acid fumes, wooden construction is often far more resistent to corrosion than metals or masonry.

The disadvantages of heavy mill buildings are these: They are more subject to vibration than other types; they are not permanent; they are not wholly fireproof; and they are subject to rapid deterioration if the processes they contain require or develop considerable humidity.

Concrete construction possesses the following advantages: It is rigid, permanent, strong, as nearly fireproof as anything that has yet been achieved, and relatively inexpensive to construct. Its disadvantages are the difficulty of altering the building, the fact that concrete floors are subject to dusting, and frequently require a surface of some other material, and that concrete (like other masonry) is subject to corrosion by chemical fumes of certain types. Most of these disadvantages are overcome if the structure is properly designed.

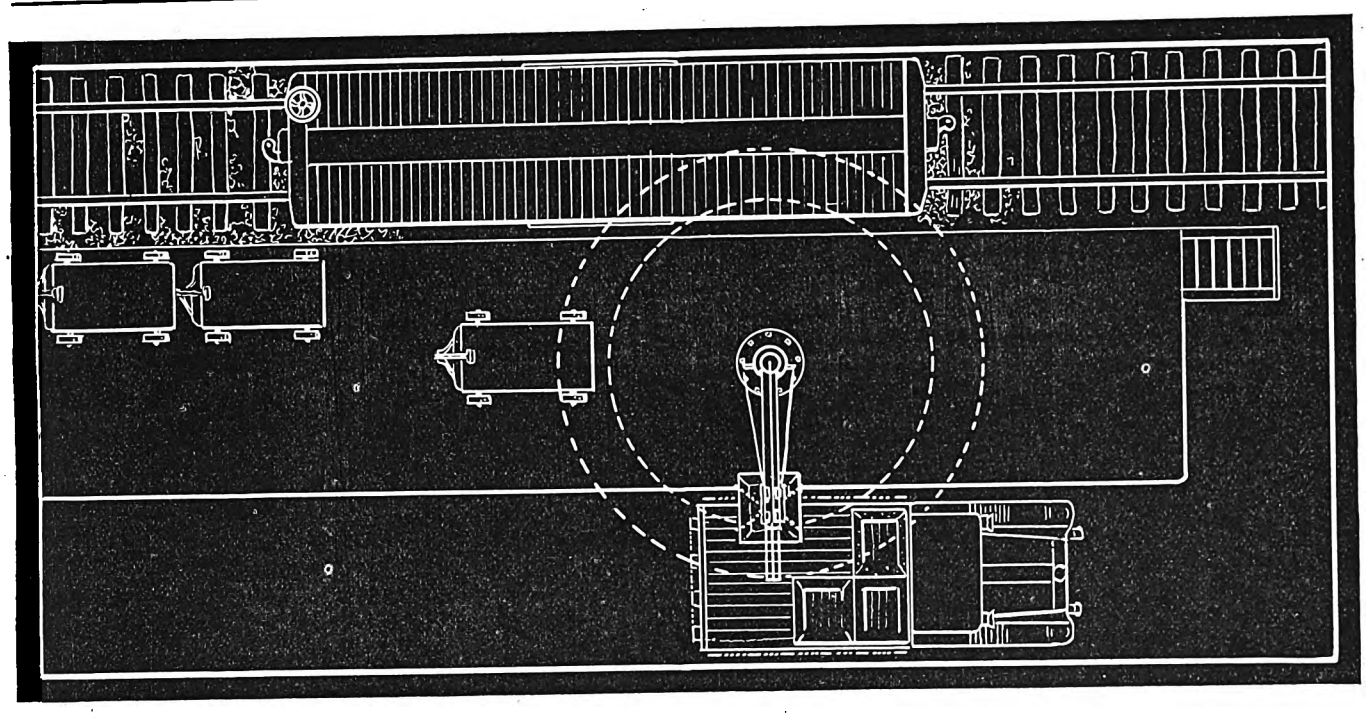
Unprotected steel construction is principally used in structures having unusual spans requiring trusses or other elaborate framework. Though usually considered fireproof, unprotected steel is a very hazardous material in the event of fire because if the columns or beams are heated by even a local blaze they are likely to collapse and distort or bring down with them a great portion of the structure not otherwise affected by the fire. Of course, steel is also subject to corrosion by acids or water unless properly protected.

Protected steel framework is lighter than concrete and is useful for tall buildings having relatively light floor loads. The masonry protection around steel columns practically prevents damage from fire. The choice between reinforced concrete and protected steel construction for buildings of normal floor loads depends a very great deal on the local cost of each type as their merits are otherwise almost identical.

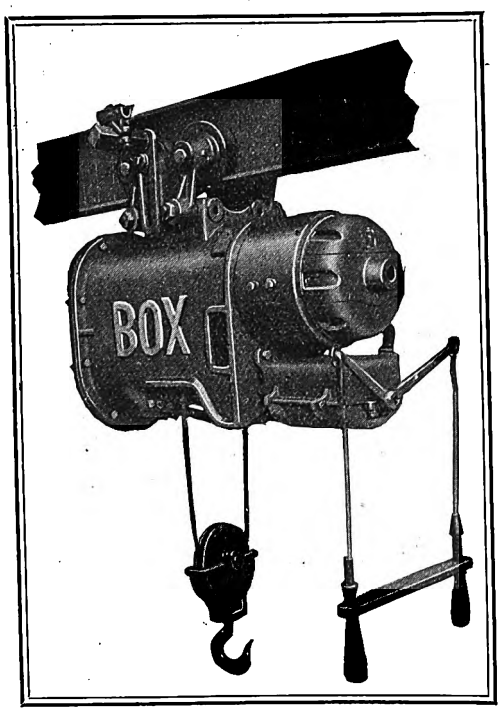
The final planning is almost a repetition of the process we have already outlined except that finer details are considered. The machinery templates are rearranged with precision on floor plans of fairly definite dimensions, and proper space is allowed for conveying equipment, work in process, and for the operatives. Columns are provided for in such a manner as to interfere least with the machines on all the floors, a process sometimes requiring a readjustment of the ideal arrangement here and there, for the columns must be directly in line, one above the other, except in very special cases. Likewise the stair towers, elevators, fire escapes, and the toilet and wash rooms are located in the positions which best meet the requirements of all floors taken together, for these items also need to be aligned vertically in most cases. It is often good practice to place all of these units in towers or small wings outside the main lines of the building to prevent their intrusion into an otherwise uniform floor arrangement. A clear open floor is a great aid to supervision.

Each item of equipment is next considered separately and

(*Continued on page 76*)



Everything Within Reach



One electric "Load Lifter" can be arranged, so placed that it will do a vast amount of quick, easy lifting. The illustration shows just one of many installations where the "Load Lifter" does a large amount of important work.

On a loading platform, from a self supporting jib crane, the electric "Load Lifter" handles merchandise from factory trucks to delivery trucks and railway cars. It is operated by one man. All lifting and shifting is done quickly, easily, most efficiently and at a very small power cost. The "Load Lifter" is on the job all the time—always ready for work.

The "Load Lifter" is BOX designed and made. Small, compact, powerful. It is in a lifting class all by itself. Absence of gears, cams and exposed parts instantly appeals to men who know machinery.

Let Box "Load Lifter" Engineers assist you to cut your lifting and shifting costs. Information and advice will be sent you by mail and is yours for the asking.

Alfred Box & Co., Inc., are also builders of the "Box Crane"—a standardized, heavy duty, Electric Traveling Crane in capacities of twenty tons and under; also builders of hand operated Traveling and Jib Cranes of any capacity. In addition, full line of Electric Hoists to five tons capacity—embodied in which are all the important features found in the "Load Lifter."

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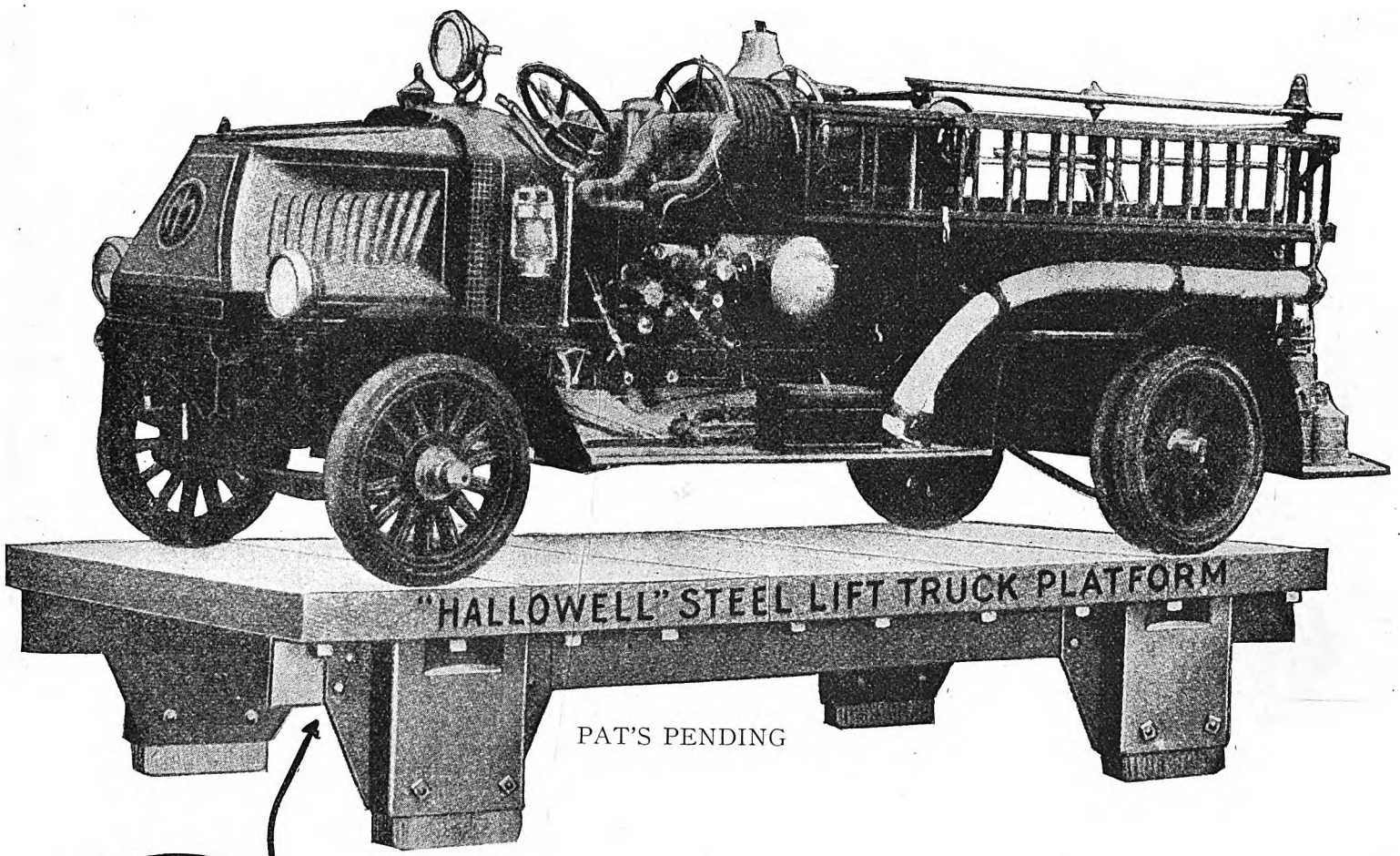
BOX CRANES

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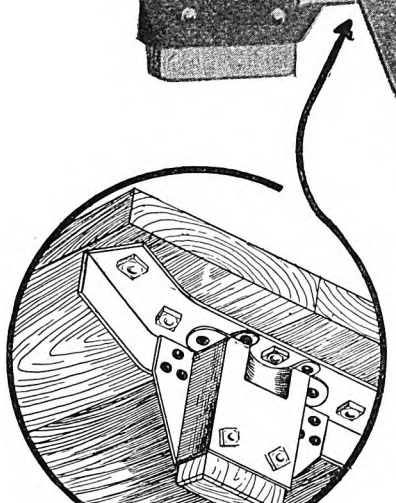
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The Platform that Carried 26,144 lbs.



PAT'S PENDING



Rivets—Hydraulically Driven —Not Bolted

"Hallowell" Steel Lift Truck Platforms are reinforced at every point where the stress and strain falls. For instance, instead of bolts, *Rivets —Hydraulically driven,* are used to fasten the steel leg supports to the runners. Bear this in mind when choosing lift truck platforms.

CAN you visualize 26,144 pounds of Babbitt Metal—13¾ tons—approximately the weight of the big Bull Dog Mack Truck shown above?

The "Hallowell" carrying a load of 4000 pounds was first tested by being pushed and dragged over a concrete floor with a Mack Truck. After standing up under this test successfully—quite a severe test—the load was increased to 26,144 pounds simply to determine whether or not any hidden weakness had developed. Every severe test was successfully met.

You will want to know the other reasons why the "Hallowell" construction means longer life to lift trucks. Write for details and prices.

STANDARD PRESSED STEEL CO.,
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HALLOWELL

STEEL LIFT TRUCK PLATFORMS

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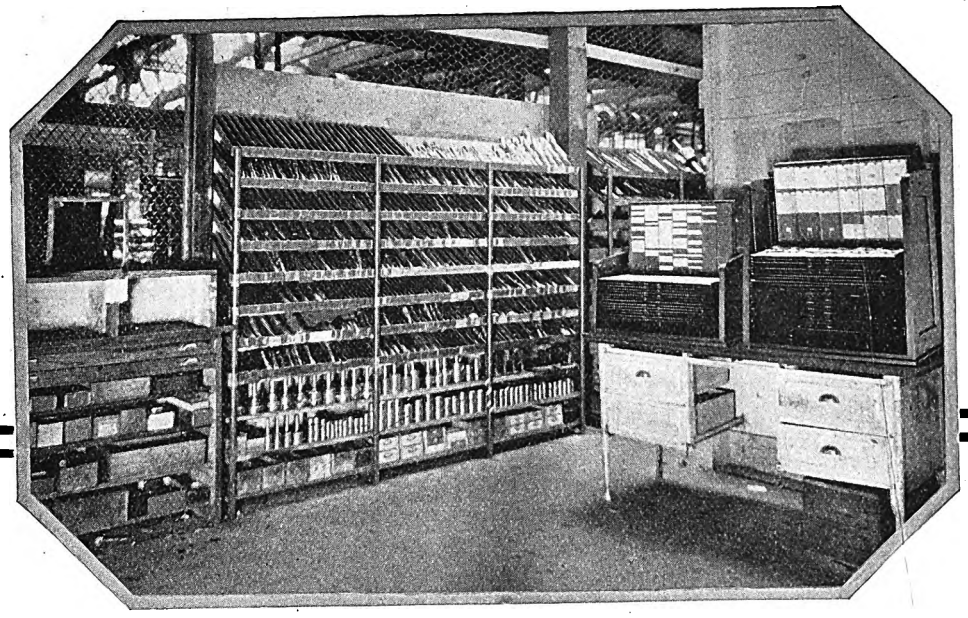
(*Continued from page 74*)

is designed to fit into the structure as now planned. In the electrical work the power requirement of each machine is determined and feeders are planned to distribute the power where needed. Control points are fixed, and if a power plant or sub-station is required, this is designed in detail. The location of switchboards, conduits, and distributing panels is marked on the plans, lest other equipment be placed in a way to interfere with their arrangement or utility. The lighting system is also planned, with illuminating units chosen and placed with reference to the needs of the machines and processes with which they are associated. The distribution of current to these units and to the switches controlling them is likewise designed and marked upon the plans.

The heating apparatus required for a building is an expensive and complicated item, as any owner will agree who has paid the bills. Yet too often the arrangement of the radiators, ducts, and the mains and return pipes is left to a heating contractor whose principal interest in the project lies in the profits he can draw out of his contract. Each part of the heating system must be planned with the same care that is given to the other parts of the structure, for pipes must not interfere with each other or with the machinery, electrical conduits, sprinkler lines and plumbing system. In the same manner each of these other items of equipment should be studied and adapted to the building in such a manner as to avoid conflict with each other and at the same time to cost as little as possible to install and operate.

The means of transporting material should be settled in detail, for the installation of the equipment will affect the structural design of the building. Monorails and trolleys or telephers require suspension from the ceilings, with space for switches and sometimes for transfer cranes. Electric hoists and travelling cranes require special supports from the floor or walls. Elevators of course have their shafts and pent houses, and require careful selection of their size, speed, and doors according to the work they are to do. If hand or electric trucks are used to move the material through the aisles, the elevator doors must have smooth sills, the aisles must have ample width and the corners at aisle intersections must be of such radius as to permit the trucks and trailers to negotiate the curves without striking. Belt, gravity, bucket, drag, and other kinds of conveyors likewise influence the structure for most of them require floor openings and special supports.

Upon occasion, this planning of equipment must go even farther, to arrange for shafting, motor supports, process piping (such as process steam distribution) air washing and conditioning equipment, dust collectors, vacuum cleaning systems, and compressed air distribution. In a number of plants the writer has been concerned with it has been necessary to control the humidity of the air within one or two per cent., and to control the temperature within a degree. Sometimes the temperature must be high, oftentimes it must be very low. This means refrigeration machinery and piping, cork or other insulation on the floors, walls, and ceilings, a



In the Richards-Wilcox Plant, Aurora, Ill.

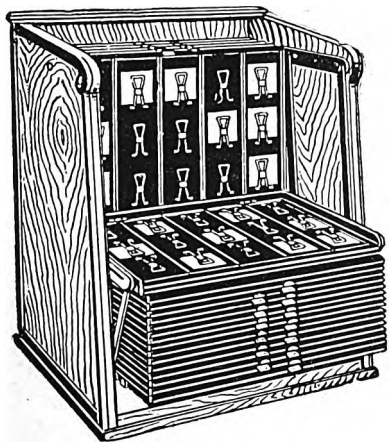
A 15% Cut in Tool Expense

Since They Installed a McCaskey

THAT'S what actually happened in the plant of the Richards-Wilcox Manufacturing Company at Aurora, Ill. But it's only one of the surprising benefits they derived from their McCaskey Register—benefits that may be yours as well. Read the others in the following letter of Mr. R. H. Bellmore, Assistant Superintendent and Production Manager:

"A reduction of over 15% in tool expense, the releasing of hundreds of dollars formerly tied up in over-stocked tools, the saving of many dollars lost in idle time and in holding up production while hunting for dies, jigs, etc., are some of the results we have accomplished in the past year with our McCaskey register.

"Now when a workman needs a new tool, a die, jig or sample he has just one place to go—our tool room. Before, each foreman kept a supply of tools in his desk, and no record was kept of who used them or when they were used. The dies and jigs had no definite place. To get anything from the tool room now, the workman must fill out a form in triplicate showing the tool, jig, die or sample drawn, the date, department and the signature of the workman. The original is filed in the McCaskey workman's register under the workman's number. A pink triplicate is filed in the McCaskey tool register under the number of the tool, and the yellow duplicate is given the workman.



Making the Workman Careful

"The workman has to account for everything charged against him in the register, and if tools are broken through his carelessness, or are lost, he has to pay for them. Naturally he is much more careful, and as a result we are buying over 15% less tools than formerly. We know too, just what tools we need and what we don't need. We used to order a large quantity of everything when we ran low. Now we order according to how fast we use the tools, and thus we are not tying up our money in slow moving stock.

"When a workman is through with a die now he brings it back to the tool room instead of throwing it down anywhere and forgetting it. We used to spend a day or two at a time looking for lost dies and jigs. That meant idle workman's time to say nothing of the loss due to held-up production. Everyone is enthusiastic about the savings we have effected through the installation of the McCaskey. And even the individual workman is more productive because McCaskey has made him more careful."

And in Your Plant—

You, too, no matter what your business may be can derive benefits of this character by installing a McCaskey System designed for your needs. It is no trouble to find out about them. Write us today.

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double glazing in the windows, all of which is most economically installed if provided for in the original structure.

It is only at this stage that the structural plans are prepared in final form. We now know where every opening will come in floors and walls, where extra loads must be supported, and where economy of material will be possible because the loads will be permanently limited to an established maximum. The size of the columns is finally determined, the floor slabs or beams are designed, the structural or reinforcing steel is figured and the structural plans completed showing all of these elements in detail.

Now all of this detail is mentioned for a purpose. It is to bring about some realization of the importance of knowing what you want before you start planning, and of planning every detail with precision and thoroughness. Contractors are going to bid upon the plans and specifications of your building including every one of the items we have mentioned, and if your plans do not show exactly what you want your contractors will guess and gamble on what they think you want. And you may be dead sure they will gamble so as to win whichever way the bone rolls. Their estimates will include contingency items in proportion to the lack of precision and completeness of your plans.

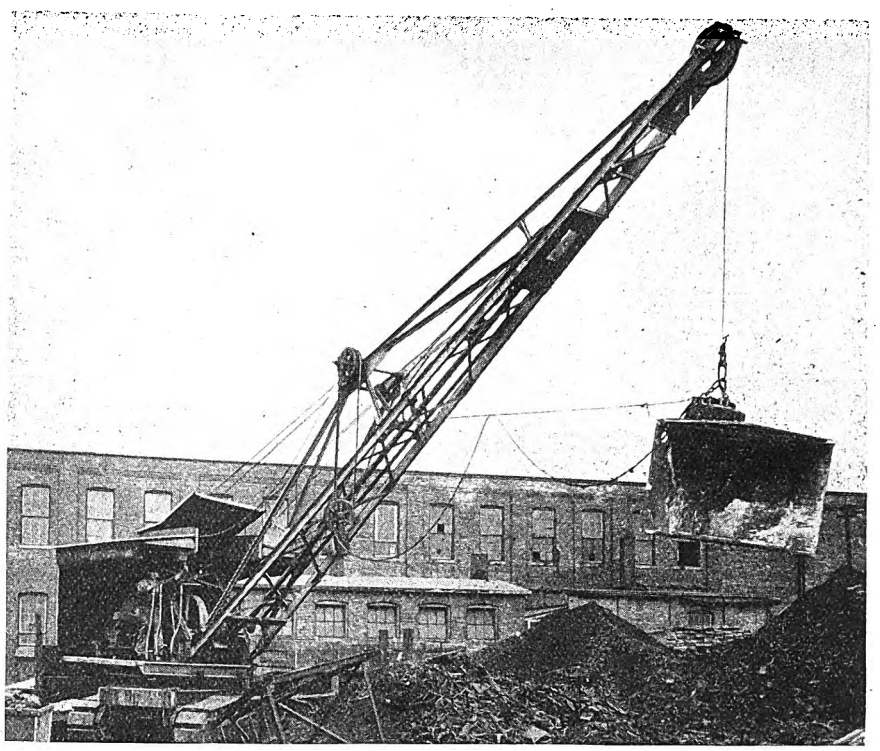
Few people appreciate the fact that a manufacturing structure is a machine producing goods. It should be designed as machines are designed, to turn out a given product with the least consumption of power, effort, and material. Yet generally the building is considered apart from its product. If our mechanical engineers started designing machines just as pieces of machinery, without thought to what the machine would produce, how far would we progress industrially? Or if they first designed a machine and then converted it to produce a given article, how efficient would the resulting piece of equipment likely be? Yet we blithely plan our buildings first and then decide what to put in them!

Of course we do not wish to imply that all buildings are inefficient and poorly adapted to the process they contain. Fortunately, very many manufacturing processes require such light and easily arranged equipment as to fit into almost any building that has floors, walls, and a roof. Such equipment often can be effectively arranged in old buildings or in leased quarters. But when a company reaches the stage of success and output that it must have its own buildings it should plan its structures in the manner we have indicated, conceiving the building as a huge machine functioning with economy to turn out the desired product or group of products.

If this thought is clearly established in your minds you will give due consideration to the maintenance of this building which is really your largest machine. You will choose materials that will wear well, that will require little attention and replacement and you will thereafter inspect and groom your building as you do your most expensive piece of machinery.

We said at the start that the process of planning a manufacturing plant is a relatively simple process, and we still mean it in spite of the mass of detail we have touched upon. Except for the collection of data and the establishment of general policies, the work of planning the building and equipment goes forward rapidly and smoothly when in trained hands. Probably no plant owner or "layman" so to speak, could go through all of these steps without the guidance of experienced counsel. It is equally true that very few if any individual architect or engineer could handle with accuracy and assurance, all of the problems arising in such a program.

The planning of a factory requires the coördinated efforts of many trained experts. The owner and his staff supply one group of brains and experience. The architect and engineer, (who must be supported by a staff of structural, mechanical, electrical, plumbing, heating, and process engineers as well as by architectural designers) supply another group of brains and experience. Our industrial progress has carried us far beyond the one man shop, and so also it has brought about the need for the coördinated effort of many specialists in planning our factories and other machines. Pay for brains when planning and you will pay less for your structure and its finished product.



Handling Scrap with P & H 206 Corduroy Crane at Plant of American Manganese Steel Co., Chicago Heights, Ill.

American Manganese Steel Company Chose The P & H Corduroy Crane Because They Wanted

Crane Service Everywhere without track or runway expense.

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The Corduroy Crane has all of the characteristics mentioned but it has something more. It has back of it the experience and reputation of a firm which, in its 39 years of existence, has built more than 7000 different types of cranes known for excellence all over the world. The ***Corduroy Crane*** must and does sustain this reputation.

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The British Coal Plan

By Thomas Meloy

THE troubles of the British coal industry have been similar to those in America until the smash-up of 1921. After it, the industry reorganized upon the largest scale profit sharing plan in the history of labor relations, and, notwithstanding several bad starts and much gloomy prognostication, the plan worked. At a recent meeting of the British Miners' Federation the miners resolved to continue the present agreement and the mine owners have recently expressed themselves as satisfied to go ahead. Neither party is satisfied, but both believe it the only possible arrangement. Two years ago nationalization of the mines appeared probable. It is now only a possibility.

In part the agreement was revolutionary, since it called for profit sharing, and this in an industry of all others the most complicated from a profit sharing point of view, and it also called for profit sharing on a scale never before attempted in any industry. It marked for British industry as a whole a radical departure in the determination of wages, for henceforth the base was to be on prices, not the cost of living, on profits. In spite of the handicap with which the agreement was written, within one year of operation the following results were achieved:

1. The rate of wages was cut in two.
2. The labor cost per ton was cut almost to one-third.
3. Production was substantially increased.
4. Unemployment in the industry was reduced to a minimum.
5. The coal business was revived, and in spite of the depression attending the continental chaos, the present year is likely to reach or surpass the volume of the best year the industry ever had.
6. Coal has been produced at a profit in the majority of the coal fields.
7. Owners and miners have shared this profit.
8. Since 1921 there have been practically no strikes of any kind.

This is a record unparalleled in the history of twentieth century labor relations, especially in a period of constant labor unrest and a constant demand for higher wages, regardless of economics. Profit sharing, in theory at least, is usually considered to be the most sound basis upon which to build labor relations, but hitherto profit sharing has never succeeded on a large scale, and where it has succeeded the results have been due rather to the sincerity and

(Continued on page 80)

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Anchor Post Fences
FIRM ~because anchored
PERMANENT ~because galvanized

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(*Continued from page 78*)

ability of a particular executive than to the plan itself. In fact, profit sharing plans have so often failed in their purpose that the principle itself has been falling into disrepute and receives scant consideration as far as the practical leaders of labor and capital are concerned.

The success of the British plan is probably due to its simplicity, notwithstanding an apparent vast complication of details. The latter, in keeping with many other British institutions, including the monetary system, is largely the result of various traditions, historical and otherwise. These details are not essential to the plan, which works in spite of them. The essential features are about as follows:

1. Great Britain is divided into its major coal districts which number, for purposes of the plan, 13.
2. A basic wage rate is agreed upon for all of Great Britain, and this rate adjusted for all forms of labor government in each district, very much as the basic rate of the American Central Competitive Field has been so adjusted for other fields and for the different forms of labor. This standard rate as finally agreed upon represented a wage cut of more than one-half.
3. An independent firm of chartered accountants examines the books of all the collieries of each district each month and determines thereby the gross receipts and the total cost, and thereby the theoretical net profits.
4. The mine owners are allowed to take 17 per cent. of the amount of the total standard wages as a standard profit.
5. If there remains any profit when this standard profit has been deducted from the net, it is divided between the company and the men, 83 per cent. going to the men, and 17 per cent. going to the company.

This ratio of 83-17, as well as the standard profit, 17 per cent. of standard wages, was determined after much statistical research. It was originally planned to compute the total capital invested in the coal properties, and thereby to devise a return on such capital which would be fair, and which would be enough to attract more capital. In other words, a minimum capital living wage. In practice, however, it was found impossible to reach an accurate estimate of the capital invested and the ratio of profits to wages was studied over a period of 20 or more years. The results show that profits have averaged about 17 per cent. of wages.

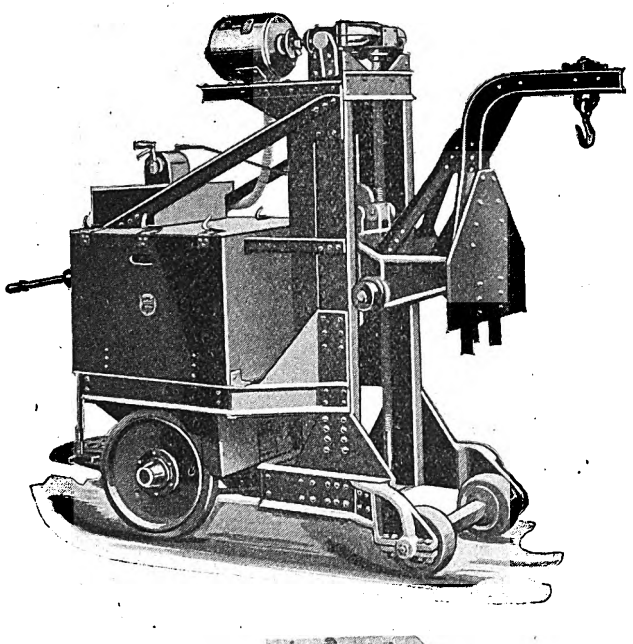
Two more provisions were tacked on to the agreement at the last moment, which later almost wrecked it:

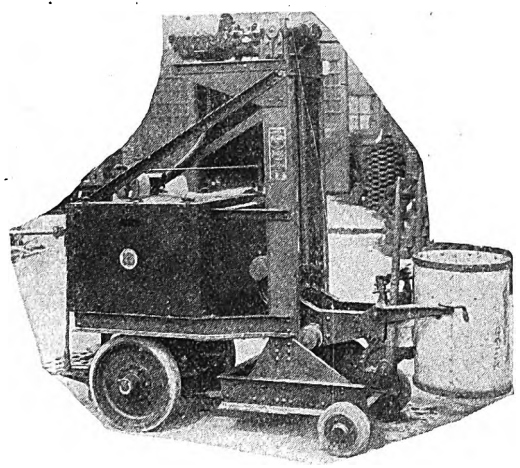
(a) That where profits were not sufficient to pay the owners their 17 per cent. standard profit, the deficiency should be carried forward as a first charge against future surplus.

(b) The cut in wages, as represented by the standard rates agreed upon, was considered too drastic, in view of the present living cost. Therefore, it was provided that even if the profits did not warrant it, the men should receive a mini-

(*Continued on page 83*)

One of Them Will Fit *Your* Needs



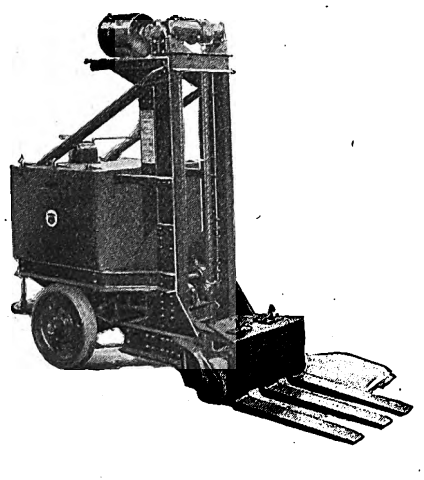


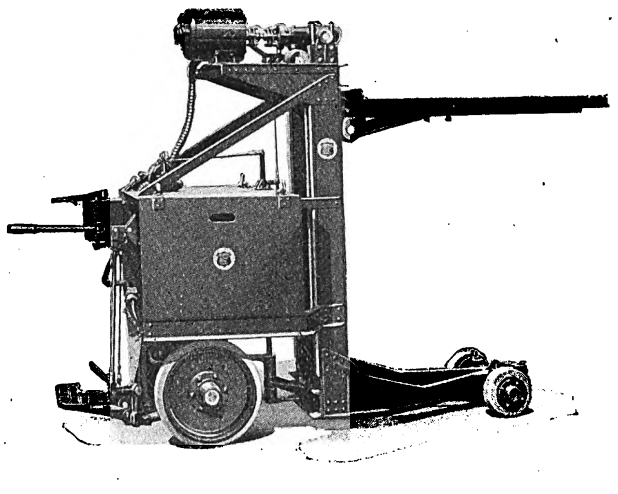
Out of the wide range of Lakewood Trucks, there is very likely to be a type that will solve your transportation problems; and, if there isn't, we'll design one for you.

Lakewood engineers, however, have met and overcome so many differing lifting and carrying questions in so many industries, that the chances are one of the present types will be just what you need.

For instance, here's a Tier-Lift Truck with a crane attachment; a Fork-Type Truck which eliminates skids, and two general types for various purposes.

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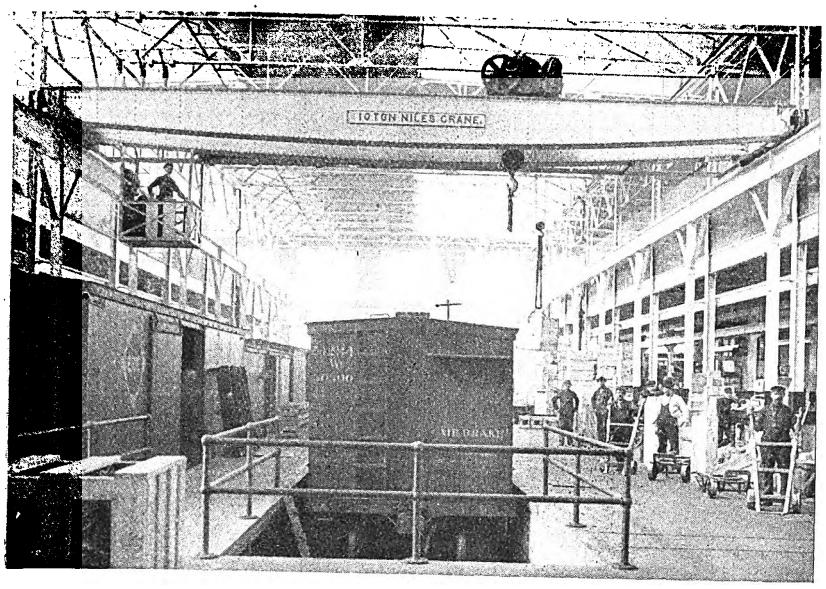


The Lakewood Engineering Co.

Cleveland, Ohio

Originators and Patentees of the "Tier-Lift"

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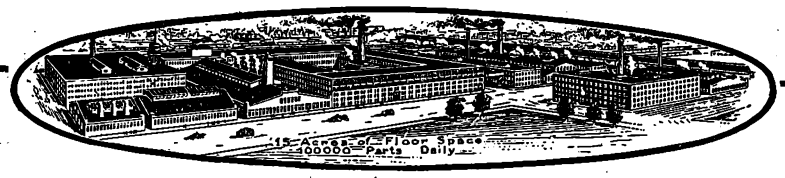
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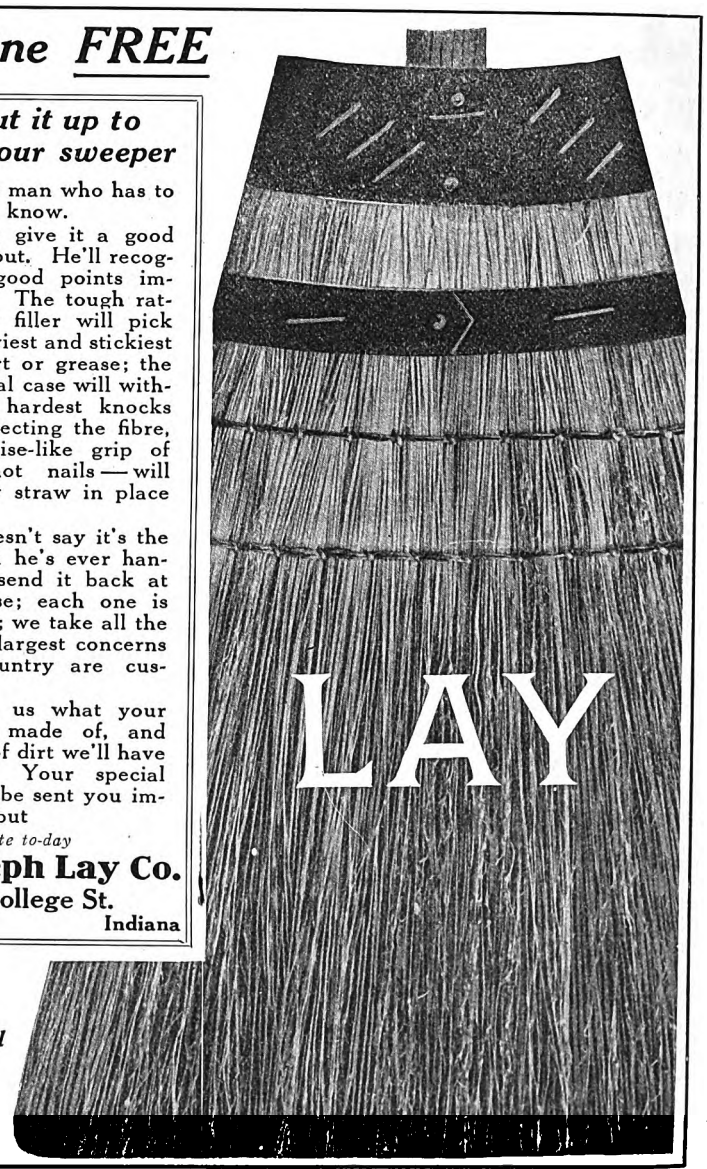
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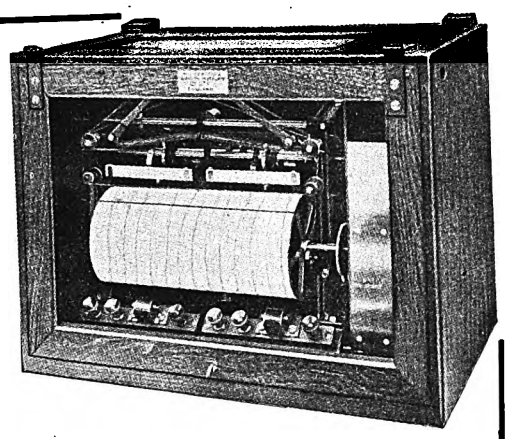
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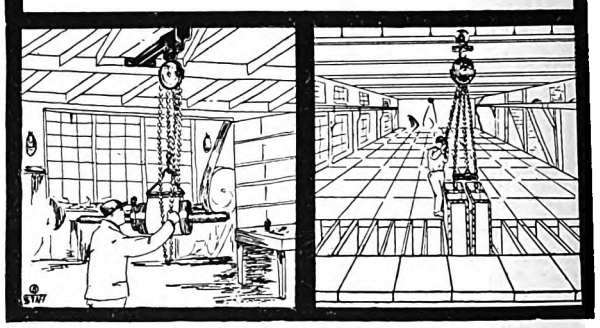
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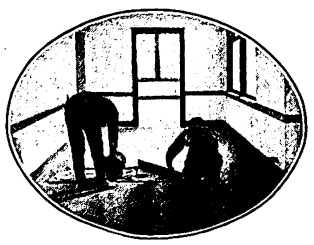
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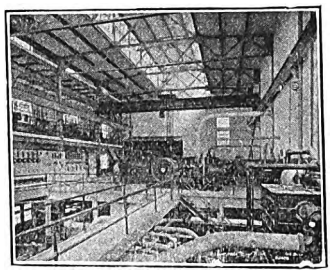


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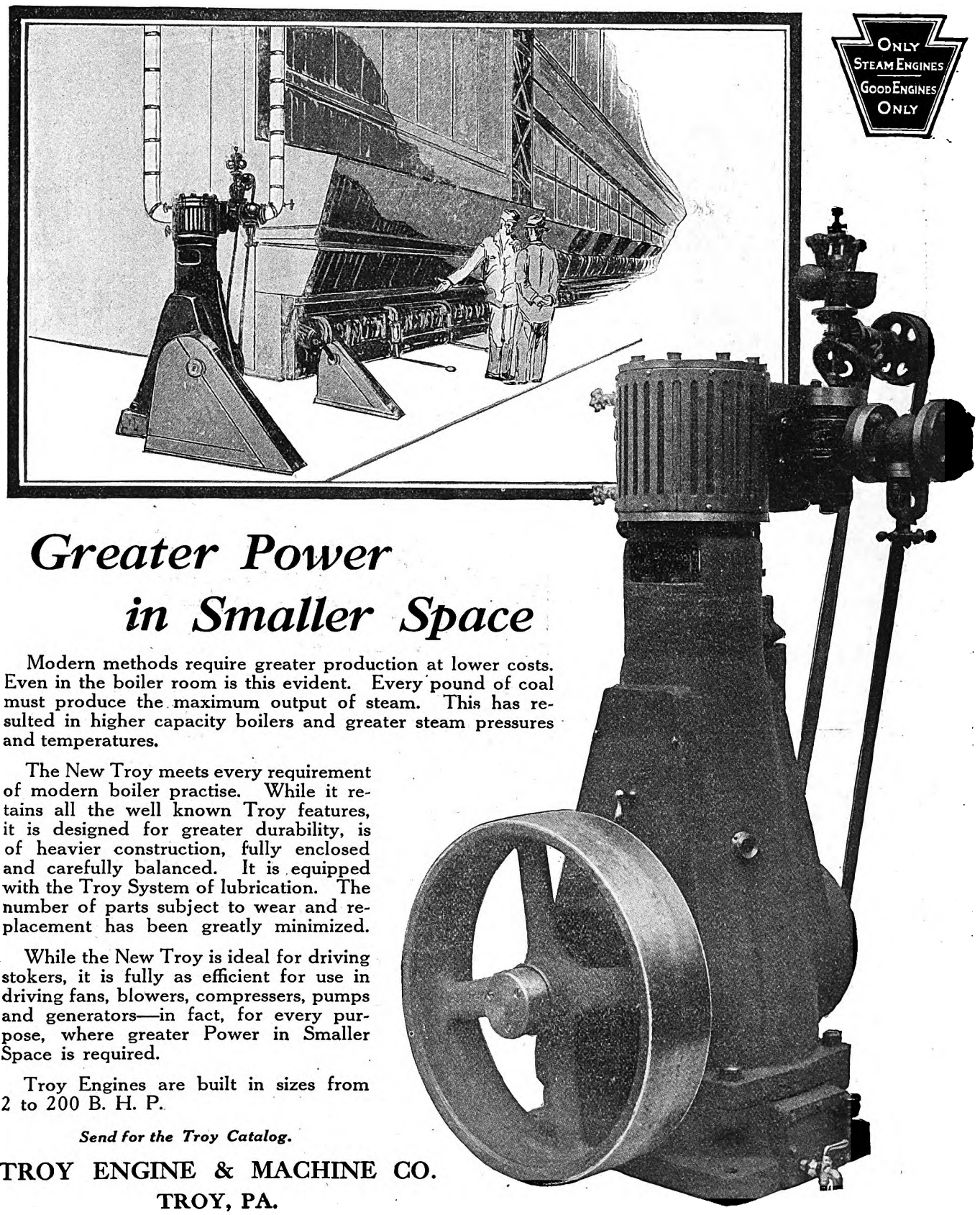
mum of standard wages, plus 20 per cent.

By a peculiarity of the wording, Clause (a) was found only to apply to loss of standard profits, and not to losses occasioned by the 20 per cent. minimum. As a result, both (a) and (b) have been continually a source of dispute. The trouble could have been avoided in the first place by making standard wages 20 per cent. higher, and possibly decreasing the 17 per cent. standard profit. The present arrangement does, however, have the effect of favoring the owners when times are good, and of favoring the men when times are poor.

There is a fundamental difference between the British plan and the general run of profit sharing schemes. Profits are not distributed directly in the form of a bonus, but indirectly in an increased wage rate. Thus, wage rates are constantly subject to profits, and are based upon them. In the beginning, for example, the independent accountants studied the returns for each month separately. During February they would study the January aggregate district income, and expenditures, and thereby determine the theoretical profits for January. The results would be published sometime before March 1st and determined the wage rates for March. Thus, if January had been a good month, and there was a large surplus, the wages for March might be standard, plus 40 or 50 per cent. If February was a poor month, the wages for April would decline. These wage rates are computed separately for each district. The fees of the independent accountants are shared equally by the mine owners and the miners. As time went on, however, the miners found the monthly accounting charges rather high; also the time limited for study. Therefore, at their request the period for the checking of the aggregate districts disbursements, receipts and profits was increased from one to two months, thereby cutting the accounting work in two. Thus, January and February are taken as a whole, and the results (worked out in March and April) are the basis of the wage rates for May and June, while March and April determine the wage rates for July and August, etc.

The new agreement has had one notable effect upon the men. It has educated them to the financial problem of coal mining. The publication of the figures prepared by the independent accountants has revealed the fact that profits are surprisingly low. The men have also discovered that directors' fees and salaries lumped together amount only to a small fraction of the total charges, and if entirely abolished, would not perceptibly affect their wages. They have also come to an appreciation of the uncertainties of profits and the narrow margin between profit and loss. Some of them have lost their enthusiasm for Government ownership, as they see that even if all the profits were paid in wages, a slight inefficiency of management upon the part of the Government could readily wipe out all the advantage.

The disposition of the men is to call for more details. They want to know where supplies are purchased, and to be assured that there is no waste. At first, this increasing inquisitiveness may seem to the mine owner



Greater Power
in Smaller Space

Modern methods require greater production at lower costs. Even in the boiler room is this evident. Every pound of coal must produce the maximum output of steam. This has resulted in higher capacity boilers and greater steam pressures and temperatures.

The New Troy meets every requirement of modern boiler practise. While it retains all the well known Troy features, it is designed for greater durability, is of heavier construction, fully enclosed and carefully balanced. It is equipped with the Troy System of lubrication. The number of parts subject to wear and replacement has been greatly minimized.

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dangerous, but it is a healthy tendency. The men are interested in economizing supplies where possible, and suggest means of saving. Several mine owners' associations have capitalized this spirit, and distribute placards stating, for example, that 83 per cent. of every mine prop saved belongs to the men, etc.

The British miners' union is now dealing with clean-cut economic facts. They see that even if they obtained all the profits, there would be only a small increase in wages. They seek to increase profits. They propose to increase operating efficiency; also to improve methods of coal distribution. As a large part of British coal is sold for export, the miners are interested in export prices and realize that they cannot increase labor cost and therefore coal prices, without losing their foreign markets.

There are two features of the British agreement that are in marked contrast to American practices.

First is a provision for the arbitration of all disputes. Under the present contract there can be no strikes. Every dispute must eventually be referred either to a district or to a national board of arbitration with an independent chairman. This marks a decided advance. For several years the American operators have asked the union mine workers to agree to arbitration as a final means for settling disputes, but thus far it has never been agreed upon. The United Mine Workers take the stand that they will not submit disputes to an arbitration board, and that they will not recognize the right of any neutral or impartial judge to enforce a decision.

Second, there is no check-off. Its nearest approach has been a demand upon the part of certain union officials that the operators employ no miner unless the latter shows a card with paid-up dues; in other words, the button system. This was rejected upon the basis that it was none of the operators' business to interfere in union affairs, and this has been acknowledged by the men.

No strikes, no violence, cheap and plentiful coal, speak well for the profit sharing agreement. In contrast, the British railway workers have a sliding scale of wages based upon the index of the cost of living. Under it the efficiency of labor has not increased. It has been the source of much dispute, and the decline in the index figure of the cost of living with the corresponding decline in wages, threatens to disrupt the entire agreement.

Aside from the possible application of the British plan to some part of our own coal industry, it might conceivably be extended to other industries. Notably, the railroad brotherhoods are constantly demanding increased wages in proportion to the increased efficiency of railroad labor. In the end they hope to secure for their members a participation in the earnings of the railroads. Labor as a whole is constantly demanding more and getting more. It would seem part of prudence as well as wisdom to give it a share in the profits rather than continually to grant wage increases, regardless of the value of what the labor has produced.



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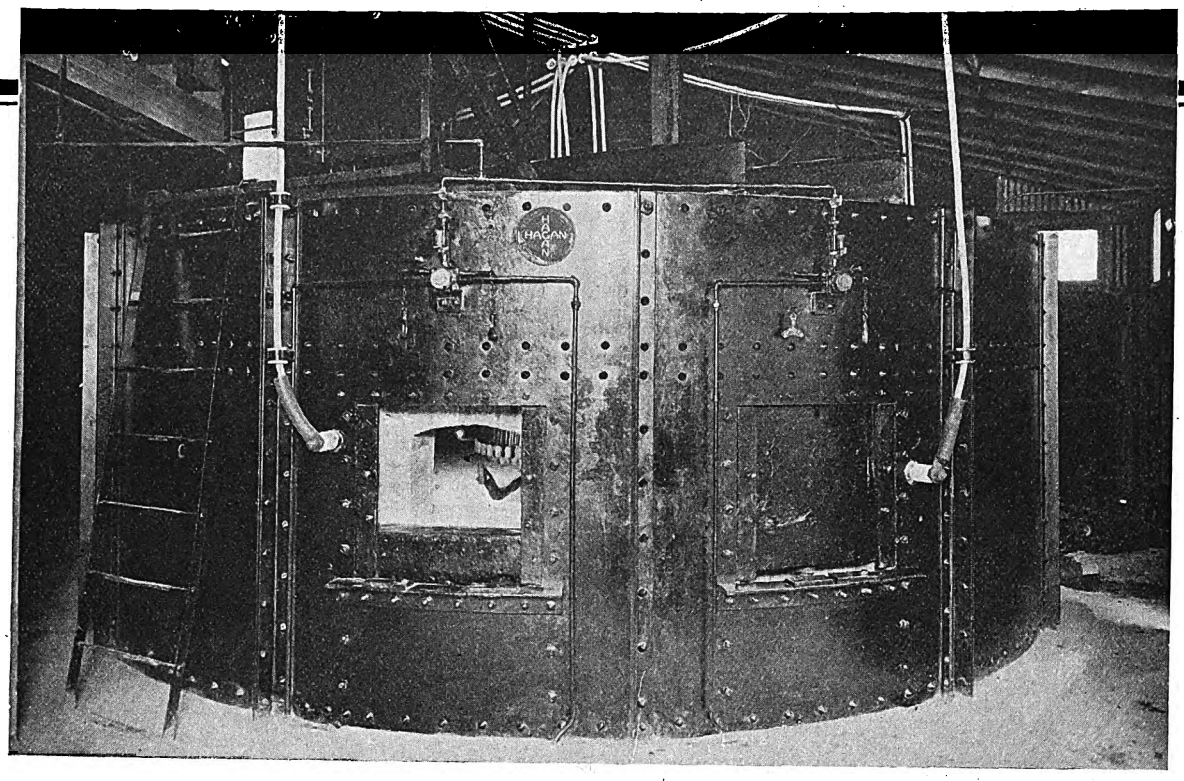
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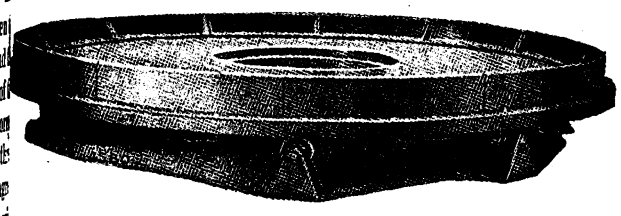


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The Bottom—Turns on a series of 20 roller bearings spaced at regular intervals about the circumference. An additional set of roller bearings is mounted radially on the main central pedestal of the furnace and forms the axis about which the table rotates.

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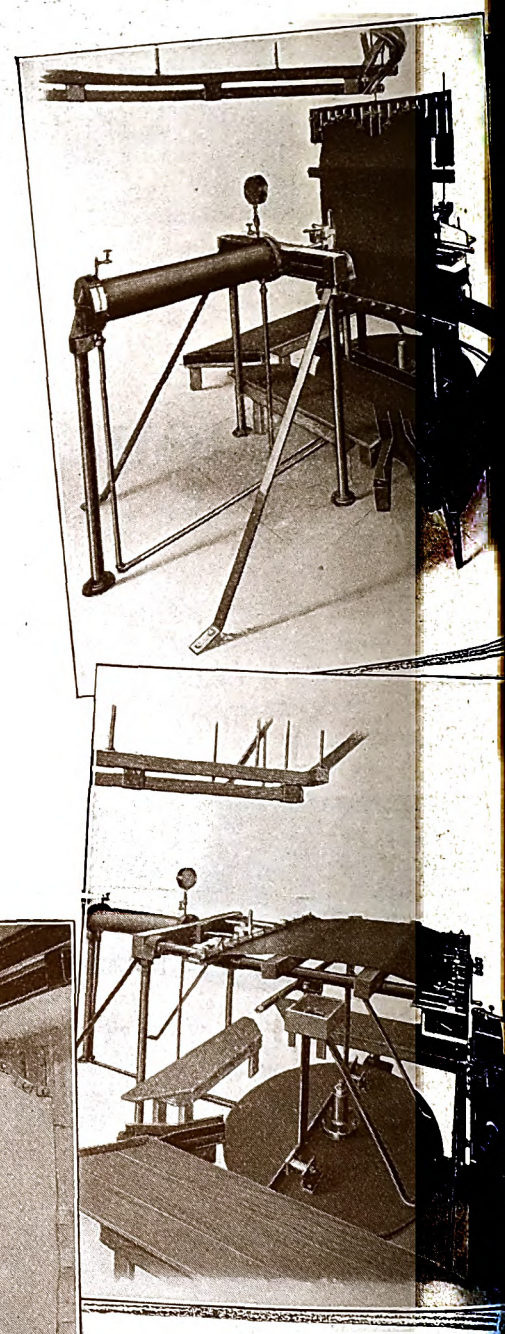
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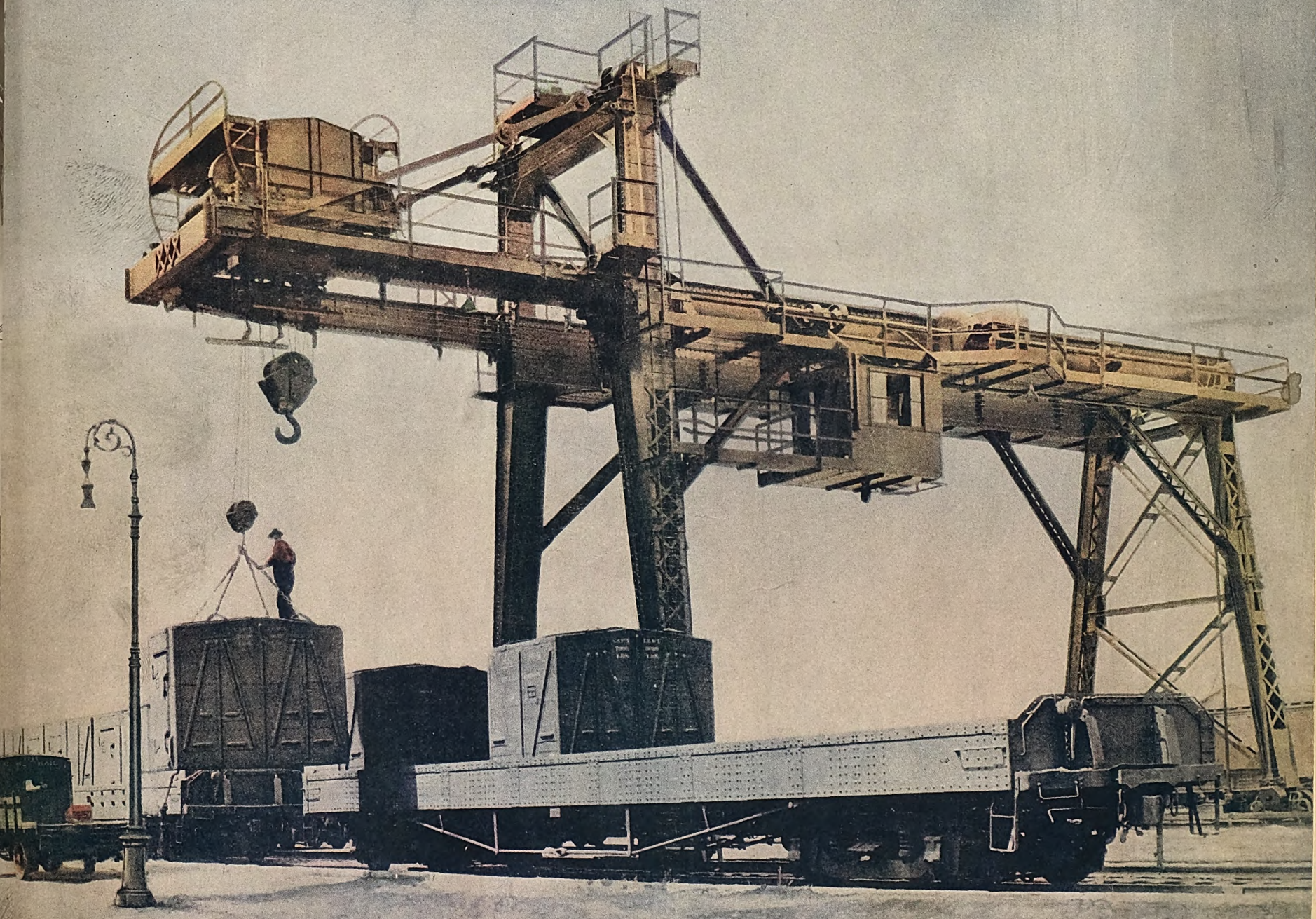
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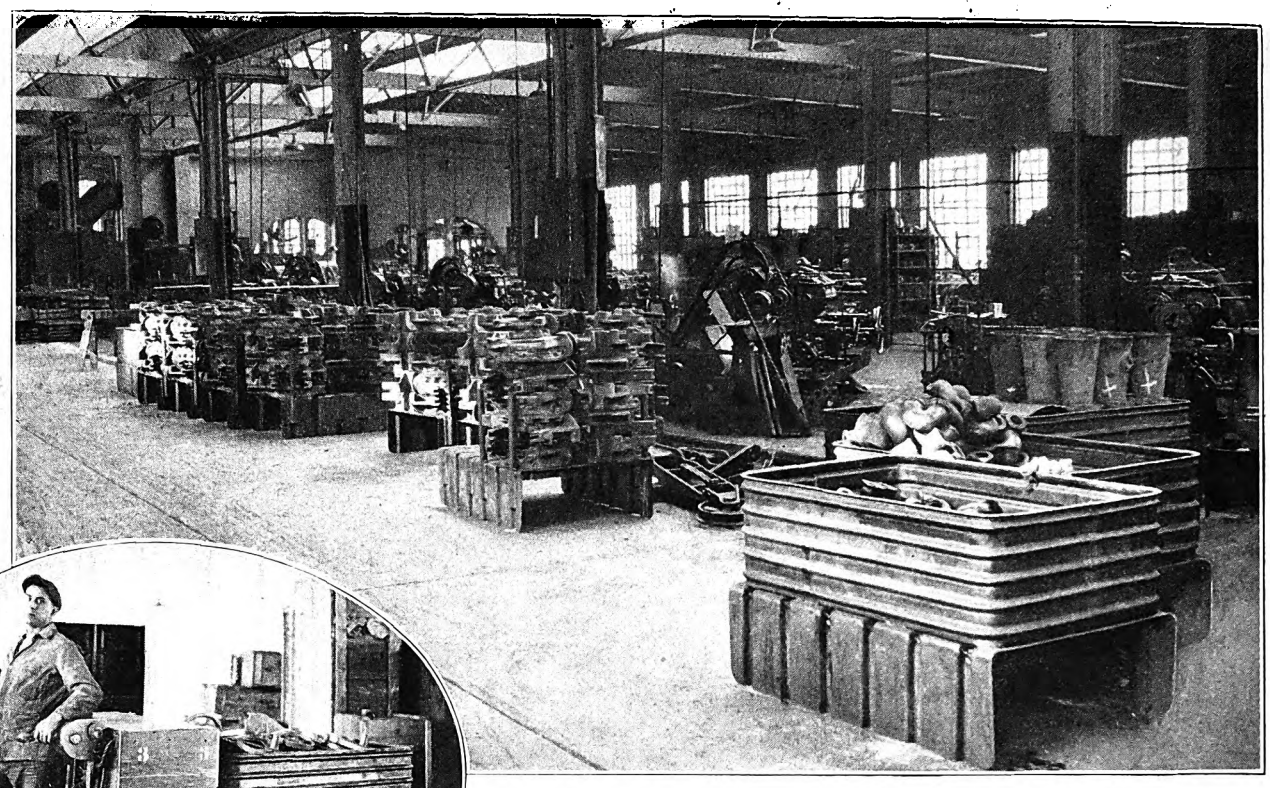
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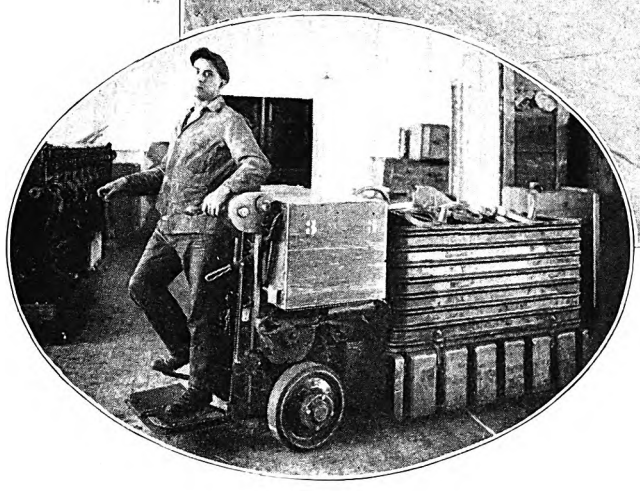


In This Issue

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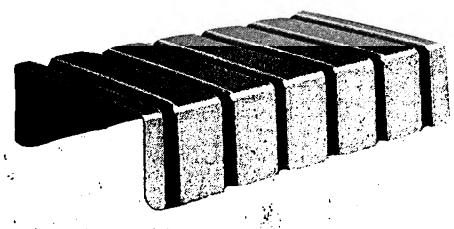
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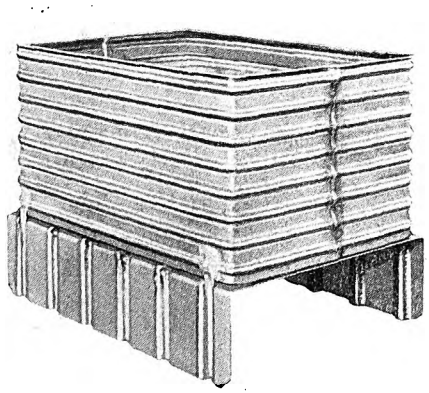
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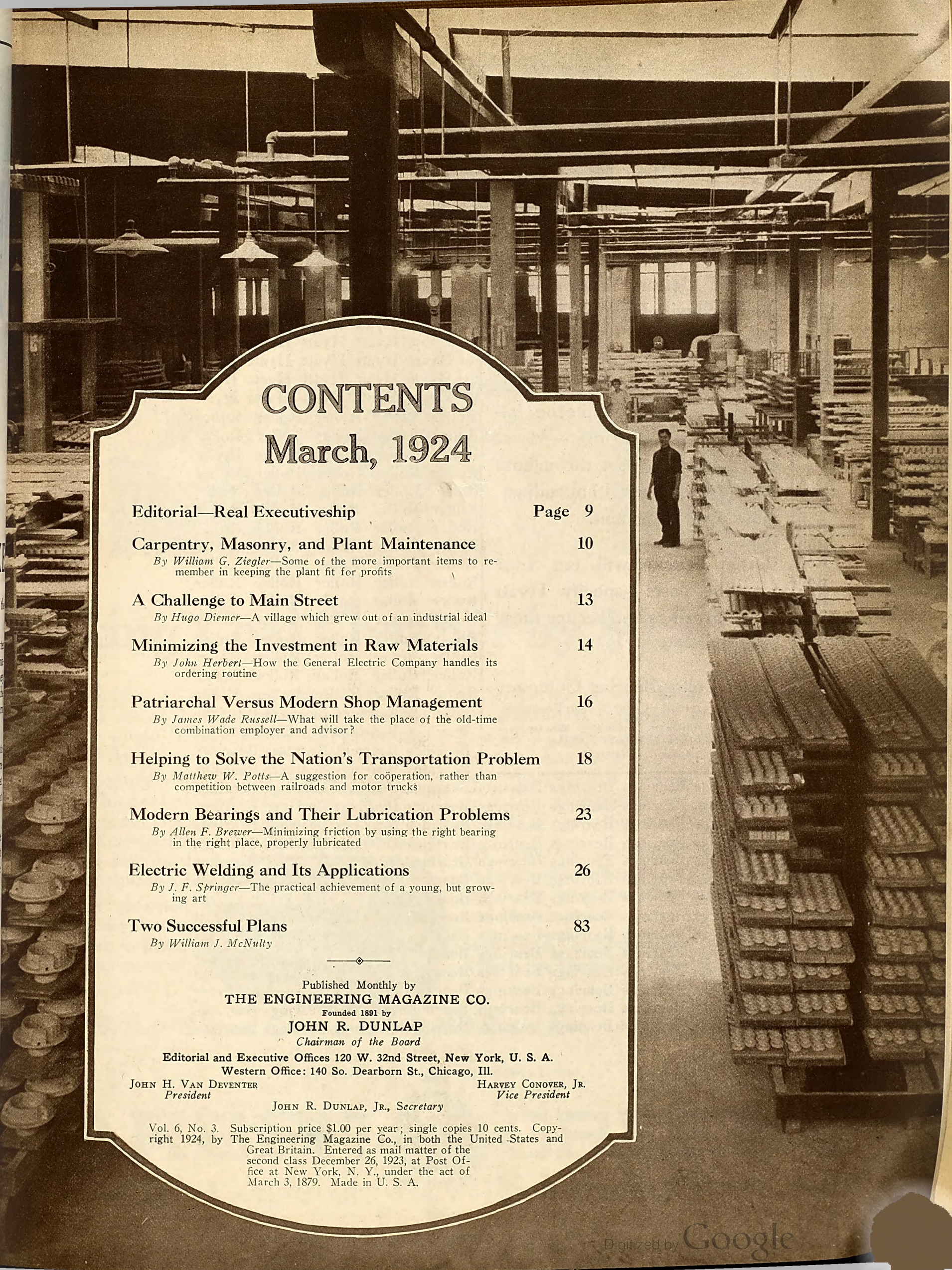
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Two wheel trucks, four wheel trucks, trailers, lift trucks—all become Better Trucks when equipped with Hyatt roller bearings.

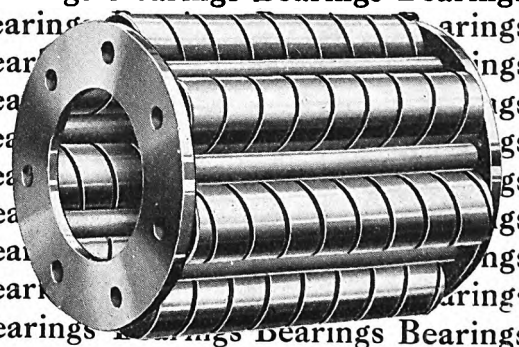
Better Trucks carry their loads easily, dependably and economically, their bearings — Hyatt roller bearings—last throughout the life of a truck without adjustment or replacement.

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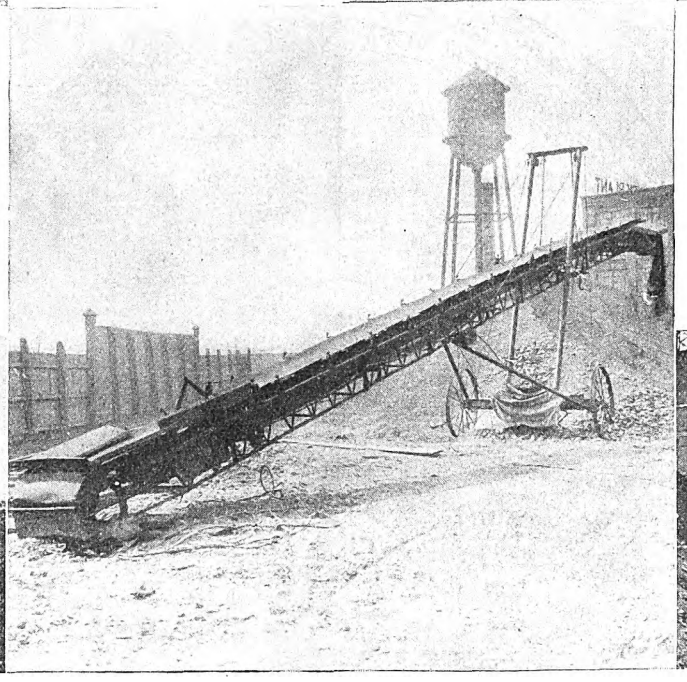


1—*After incurring a $500 demurrage in one month, the Capstan Glass Company ordered this Barber-Greene Conveyor. It completely eliminated demurrage at this plant.*



2—*For five years this Barber-Greene Conveyor has been used for unloading sand and lime, for moving them to bins, and for handling wet ashes.*

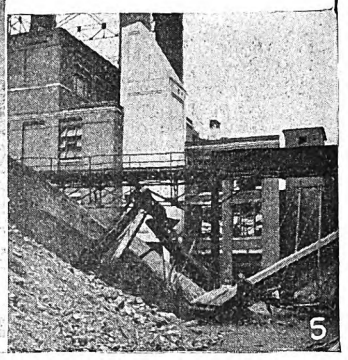
3—*Replacing a steam shovel with a Barber-Greene Bucket Loader, for loading coal and cinders at the Pennsylvania Edison Company. It loaded 109 tons in 4 hours, with only two trucks running over a 2 mile haul.*



4—*This Barber-Greene Conveyor at the Oxweld Acetylene Plant stores six carloads of coal where hand labor could store only one.*

5—*Reclaiming coal from storage piles at a large plant. The Barber-Greene Bucket Loader discharges onto a Barber-Greene Conveyor, which carries the coal to a permanent conveyor system.*





Making Coal Cheaper by $0.56 a Ton

A clear saving of 56 cents on every ton of coal bought, was one of the first economies brought about by a single Barber-Greene Conveyor at the Oxweld Acetylene Plant in Newark, N. J.

The same conveyor has multiplied the storage capacity of an area of ground six times. Where hand labor could store only one carload of coal, the Barber-Greene stores six, in but a fraction of the time previously required. And in unloading, it empties a 50-ton car in two hours.

The results obtained with Barber-Greenes in plants of every description, show a similar striking reduction in labor costs, a definite speeding up of production, and a lessening of demurrage.

After demurrage of $500 in one month, the Capstan Glass Company of Connellsville, Pa., bought a Barber-Greene Conveyor. No demurrage has been incurred during this conveyor's five years of service. For the last three years it has handled an average of 400,000 pounds of sand, lime and soda ash a week.

The constant and rapid increase in Barber-Greene sales indicates an emphatic and swiftly increasing preference for Barber-Greene design and construction.

Send for E Coal Handling Catalog and for cost reports on handling materials other than coal.

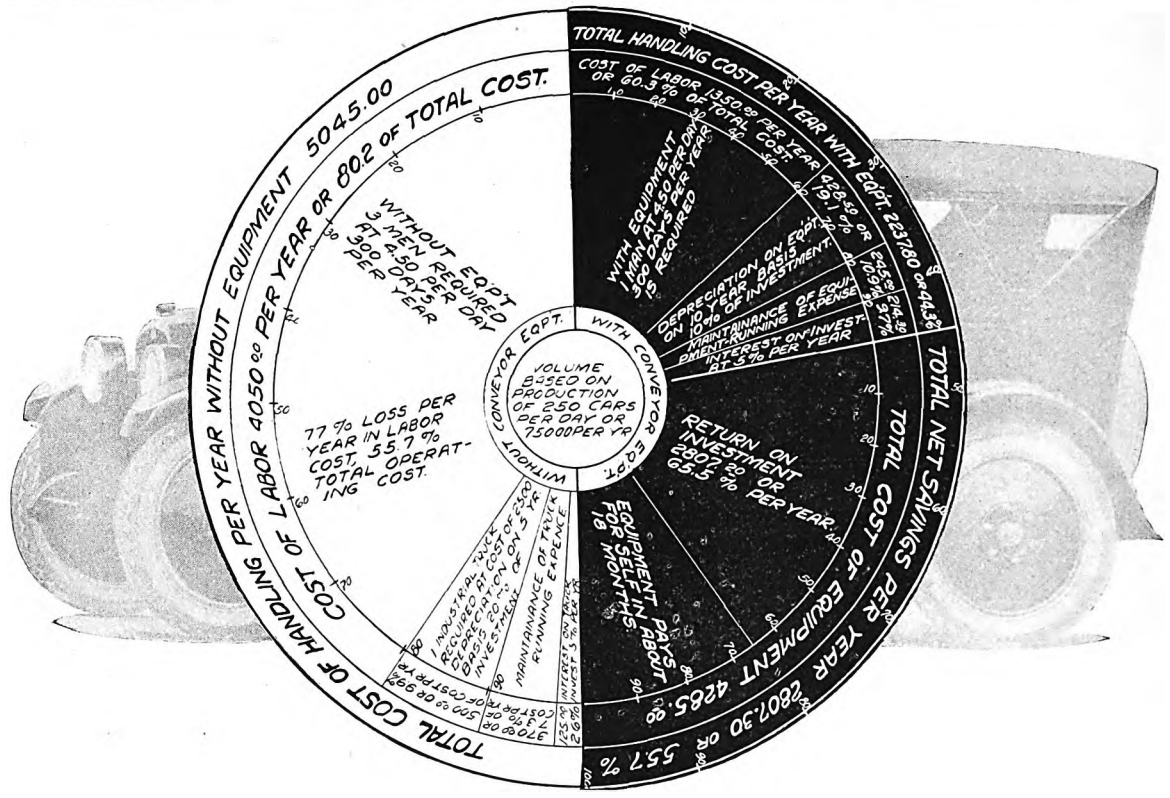
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BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

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$5045 Earns $2807.20 Yearly for Nash —in handling cylinder blocks only—

A Standard Straight Lift Elevator, some gravity roller and a spiral constitutes the unit of conveying equipment used in handling cylinder blocks in the Nash Plant.

This unit performs as the above graph shows.

When you consider that the entire Nash Plant is equipped with Standard Conveyors, we believe you will concede that Standard Conveyors may modestly claim a share of credit in making a reality of the Nash Slogan—"Nash leads the world in Motor Car value."

When industries watch closely their handling costs—they generally offer the buyer more for his money.

Standard Conveyors are built for all industries and serve one purpose —they cut handling costs. Booklet S-3 may interest you for it shows various types of cost cutting equipment. Sent on Request.

STANDARD CONVEYOR CO.

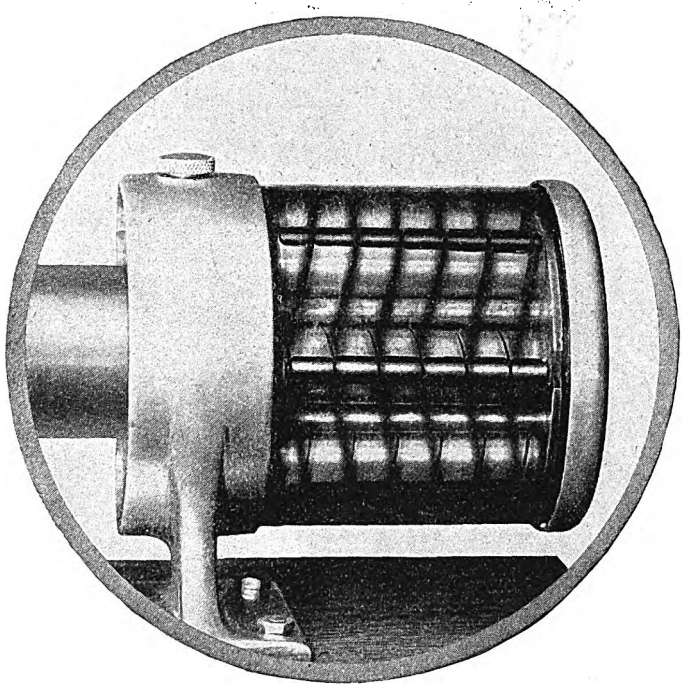
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Did You Ever See a Hyatt Roller Bearing *In a Glass House?*



Here is a Hyatt roller bearing mounted in glass instead of steel to enable you to observe the circulation of the oil.

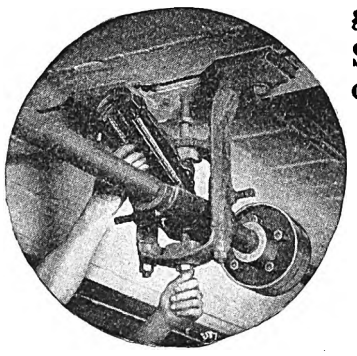
As the hollow rollers revolve, the oil flows out of the slots in parallel bands which cover the entire bearing surfaces. As long as any oil remains in the bearing it will be constantly picked up by the rollers and distributed in the path of the following rollers.

Because of this positive, self-oiling feature of Hyatt roller bearings it is only necessary to add lubricant to them occasionally, usually 3 or 4 times a year, which makes a worthwhile reduction in lubrication costs, oil and labor.

This positive, self-oiling feature of Hyatt roller bearings is only one of their good points.

Their true rolling motion saves at least 15% power and their durable high grade steel construction enables them to effect these economies for many years without adjustment or replacement.

They have been operating for from twenty to thirty years in many plants and are still in good condition.



Split throughout, Hyatt roller bearings can be applied to existing lineshafts without taking down shafting or removing pulleys, collars or couplings.

Secure these economies for your plant by asking your nearest mill supply dealer to furnish you with Hyatt roller bearing hangers.

They are just as economical and dependable in cranes, trolleys, hoists, conveyors, industrial trucks and trailers, machine tools, electric motors and any other machinery where economy and dependability of operation are desired.

'Phone the Nearest Mill Supply Dealer

Hyatt Roller Bearing Company

Newark, New Jersey

Pacific Coast Address:

Hyatt Roller Bearing Company, San Francisco, California

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Trade Mark Reg.

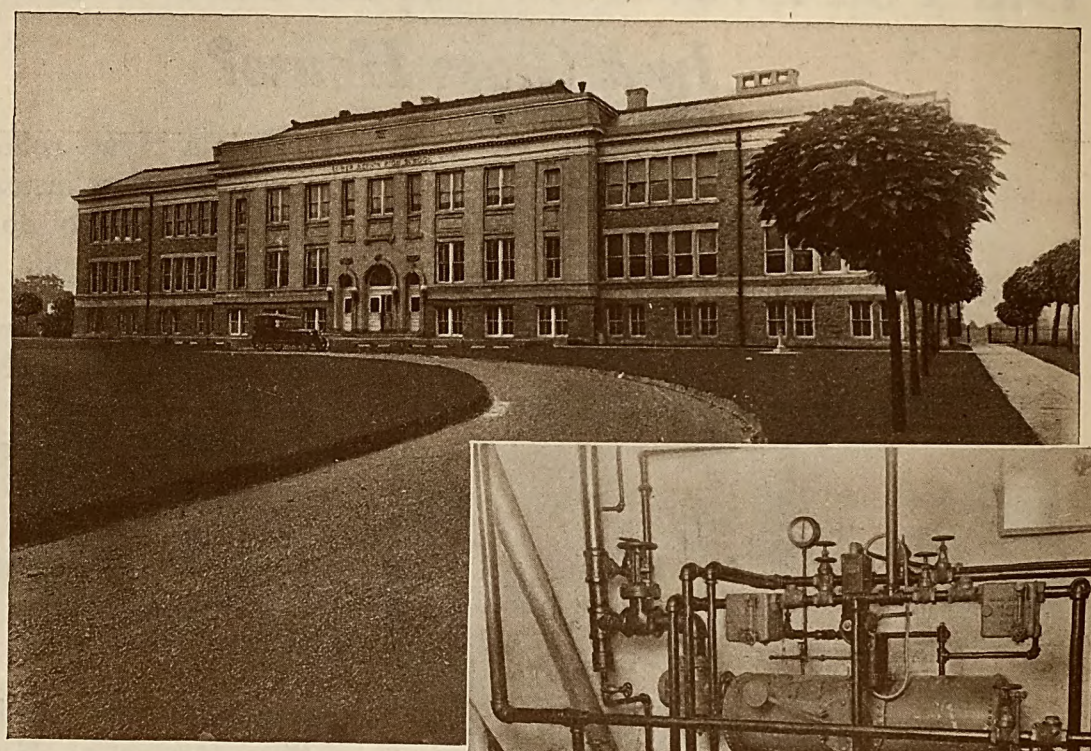
EFFICIENT HEATING *demands the* JENNINGS PUMP

Typical JENNINGS Installations

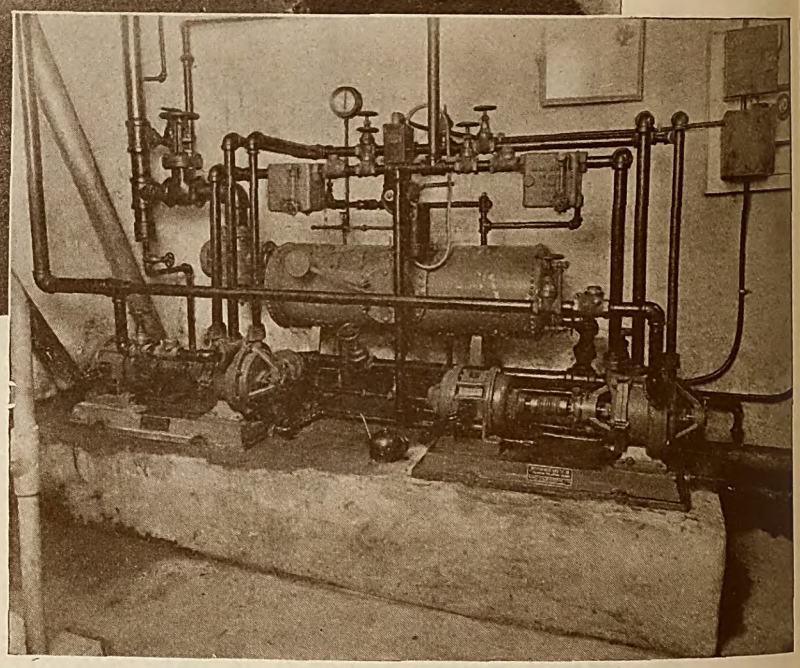
A Series

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Lower Merion High School
Philadelphia, Pennsylvania



Duplex "D" Unit
Automatic Operation

Capacity each pump 40,000 sq. feet direct radiation, air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute. The motors are only 3 horse power.

No matter how well designed a Return Line Heating system may be, its satisfactory operation is largely dependent upon the proper functioning of the Vacuum Return Line Pump. The Jennings pump has proven on thousands of installations that it possesses the features necessary for proper operation under the most extreme conditions.

Jennings Return Line pumps are simple in construction, containing but one moving element, running with a clearance in the casing. They are simple to install and operate, they require little floor space and are noiseless in operation. Their use results in a marked economy in coal. Many users hold that they more than pay for themselves in this respect alone. A Jennings pump on your system means quick heat in the most isolated radiators at a minimum steam pressure.

Now is the time to consider equipment for replacements and new installations for this season. Our Engineering Department is at all times ready to render service on problems relating to heating.

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Industry Illustrated

John H. Van Deventer, Editor

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Associate Editor

Adolf Schildkraut
Art Director

EDITORIAL

Real Executiveship

IF the whole world were governed on the same basis of efficiency as you govern yourself, would it be as dependable as it is now? To be a foreman, chief clerk, superintendent, manager or president or to hold an executive position of any kind, requires of that person demonstrated ability to govern himself. The man who cannot control his own emotions or thoughts is in no position to correct the inharmonious thoughts of the other fellows. To be boss in any organization carries with it the privilege of being an example and a guiding hand to those it is your privilege to direct.

The head of a department or the executive in charge of any business cannot create a single idea to put into that business. All that ever was or ever will be created is all ready. Therefore, his position corresponds to that of a leader of an orchestra. The leader does not put any music in that orchestra, but through his understanding of the laws of harmony he is able to eliminate the discord, leaving only the perfect harmony. His ability to produce good music is measured by his understanding of the principle of harmony.

So the man who is the directing head of any business must be able to eliminate the discordant thoughts in his own consciousness before he can do this in his organization. If he allows such discordant thoughts as envy, jealousy and selfishness to express themselves, he need not be surprised to find these same thoughts reflecting through his organization. On the other hand, if he insists that within himself he will be fair and square, honest and just, which are the elements of true harmony, he will find this true harmony reflecting to all those who are his co-workers.

The man who guides the operation of other people in their daily lives and work must accept the responsibility of maintaining a high standard of thought for himself, thereby helping those with whom he works to appreciate and enjoy the advantages of perfect harmonious conditions. To the extent that an individual is able to control his own thoughts and actions, to that extent will he be successful in controlling and directing the thoughts of others.

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Carpentry, Masonry, and Plant Maintenance

By William G. Ziegler

A LARGE proportion of the maintenance work done by the carpenters and masons is the upkeep of the buildings and their permanent equipment. This work is very important and must be well done if the plant is to be kept in good condition and remain at nearly the same value year after year. If it is allowed to run down even to the extent of having worn out floors, this neglect will directly affect, and increase, the cost of trucking and indirectly will reflect in the morale of the men. We all know that as soon as any material becomes badly worn the rate of depreciation increases, and buildings are no exception to this rule.

Wooden factory flooring is usually of a cheaper grade than that used in offices or homes, as it is not so important to have the highest grade of lumber as to have good wearing qualities. It is usually considered that oak and maple are harder than most of the other woods and therefore are very good for resistance to wear. However, hard pine has been used for factory floors for many years and has given fine service. Many woods are now being used for flooring that will make a determined bid for favor among engineers; among these being the cypress from the south and the big firs from the west coast. Most flooring is tongued and grooved to hold it solidly together, but in some plants straight sided flooring is used as it is easier to replace. When a whole floor is badly worn the top flooring should be ripped up and all nails pulled out before starting work on the new floor. Sometimes only the trucking aisle is badly worn and in this case it may be found advisable to simply lay a new floor in that portion. If the old floor is laid parallel with the aisle it is easy to rip up but if it was laid crosswise each board has to be chiseled square at the edge of the aisle. In this case the new floor is often laid right over the old one by slipping thin strips of wood called shims under the new floor as it is laid in order to make it solid.

Wood blocks are often laid, in maintenance work, directly over a worn floor of concrete or wood. In this case the surface must be levelled up before laying the new blocks. The creosoted or treated blocks have been used with good

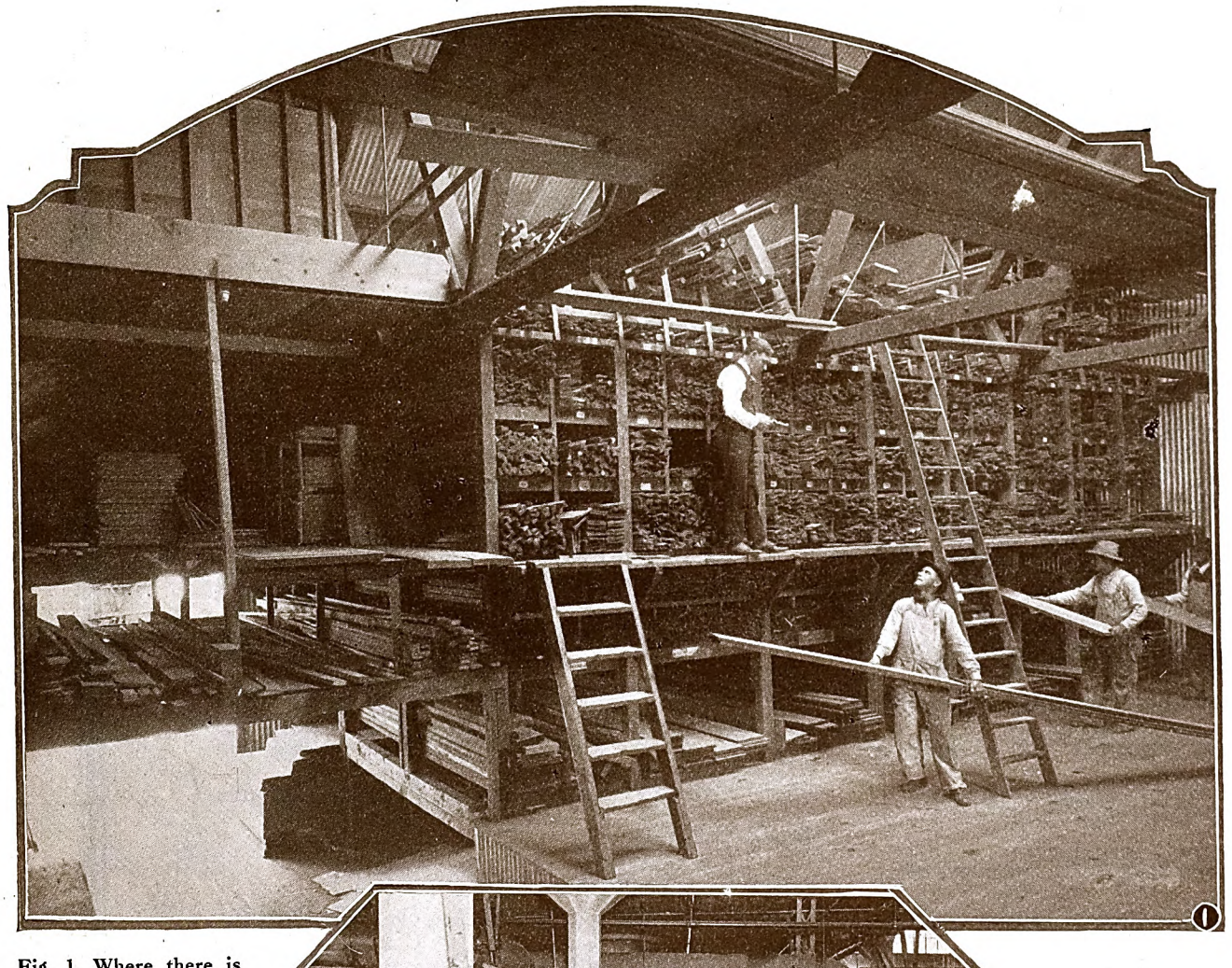


Fig. 1. Where there is much work for the carpenter in connection with maintenance and alterations, it pays to buy and stock larger quantities of the most-used sizes of lumber.

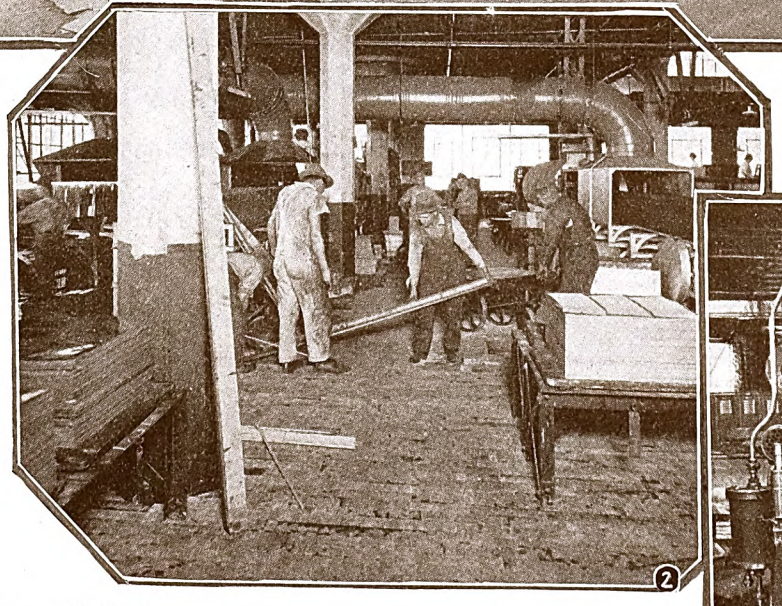


Fig. 2. Installing built-up wood block flooring over worn concrete, without interruption to production, in a plant of the American Can Company.

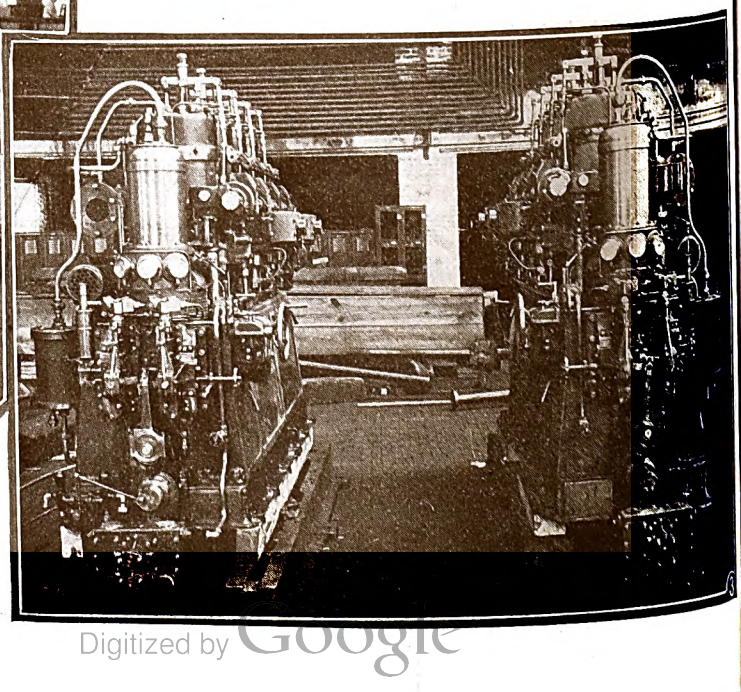


Fig. 3. The wood block floor is particularly suitable where heavy parts are handled. Note here, also, the single-tier and double-tier lockers discussed in the text.

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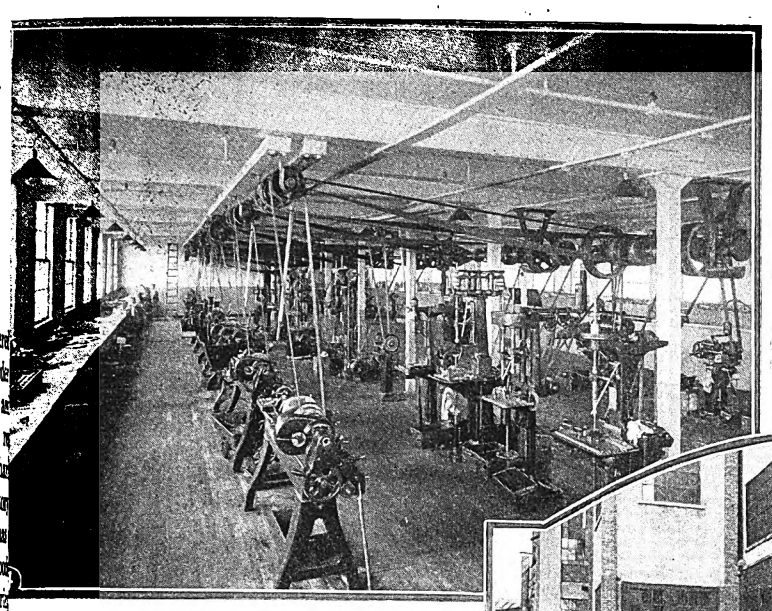


Fig. 4. The good old stand-by, tongue-and-groove flooring of maple or hard pine, and latterly of cypress and western fir, has by no means been relegated to obscurity.

uccess in maintenance work of his kind where the floor is subected to heavy trucking or sere wear. One type of blocks re dovetailed to an under strip nd these sections or lengths of locks are grooved for splines hat hold the sections or lengths ogether just like tongued and rooved flooring. One of the ewer types of block flooring is redwood block flooring from he western coast. These blocks re not treated and may therefore be used in some special laces where treated block floors ould not be suitable.

There are often places where achine operators complain bout having to stand all day on oncrete floors, especially in asements where they are apt to e cold or damp. It is often adisable to build small gratings of trips of wood for the operator o stand on. These should be made so they can be easily moved by the sweepers. When the surface of wooden floors is uneven, and this is frequently the case with newly laid floors, a rotary floor scrubbing machine can usually be equipped with a sanding disc to take care of this work.

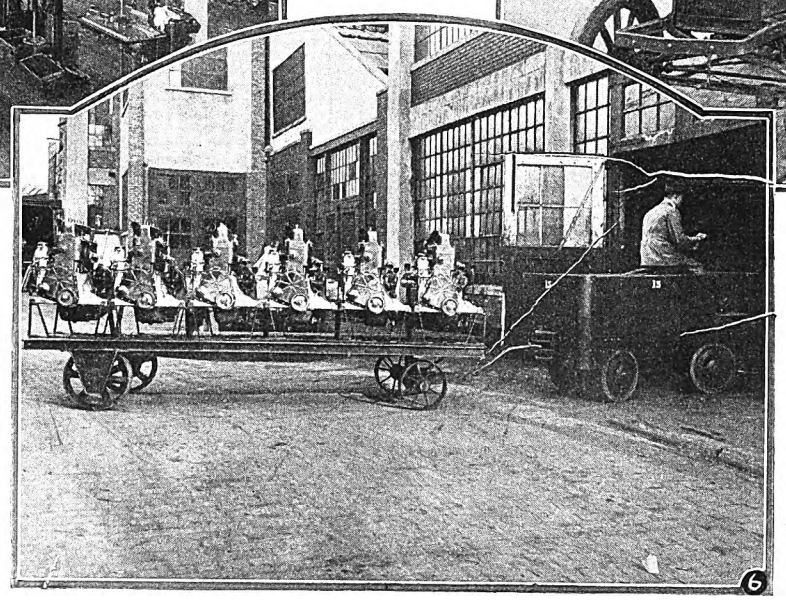


Fig. 6. Where constant trucking through doorways is necessary, provision should be made for opening the doors without requiring the truck operator to leave his seat.

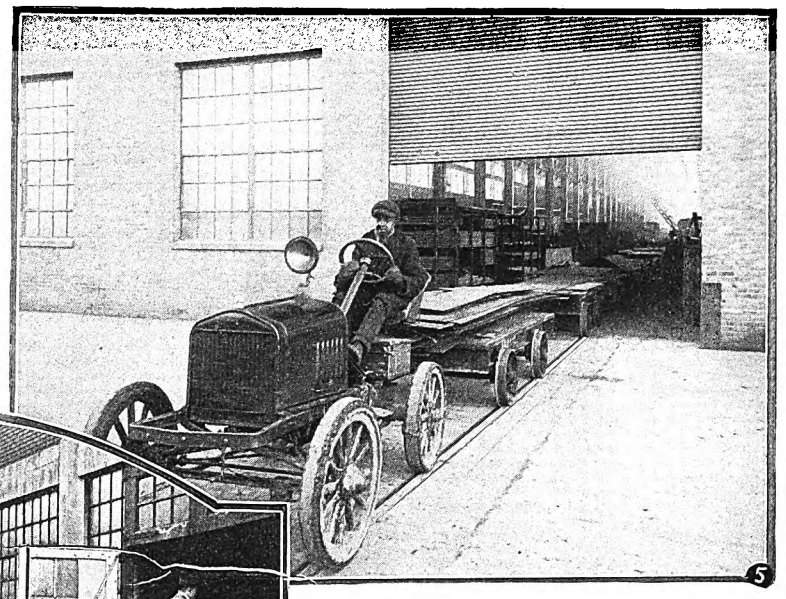


Fig. 5. For large doorways, the rolling steel door is admirable because of the small space it requires.

Good floors help to speed up production because they make the trucking of materials from one department to another faster and safer. In some plants with uneven floors, machined parts are often jarred off the trucks and the loss due to this item is often very large. It is also evident that if floors are kept in good condition the amount of repairs on trucks will be lowered.

In shifting departments around or when new or heavier machinery is installed in old mill construction buildings, it frequently becomes necessary to reinforce the floors to carry the additional loading. If the heavy loads are imposed on the first

Fig. 7. It is surprising how much money can be saved in both lumber and labor through an intelligent study of crating.

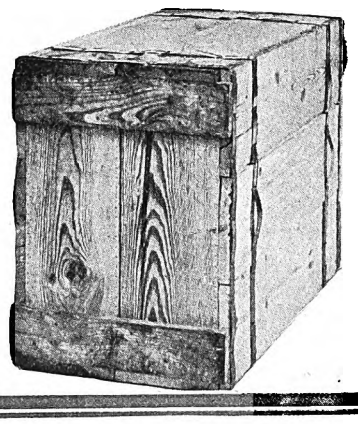


Fig. 8. Box shook machine, which takes rough lumber, from 3″ to 7″, planes it both sides, dovetails, glues the widths into solid sheets, and cross-cuts to length desired, also ripping this shook to finished width.

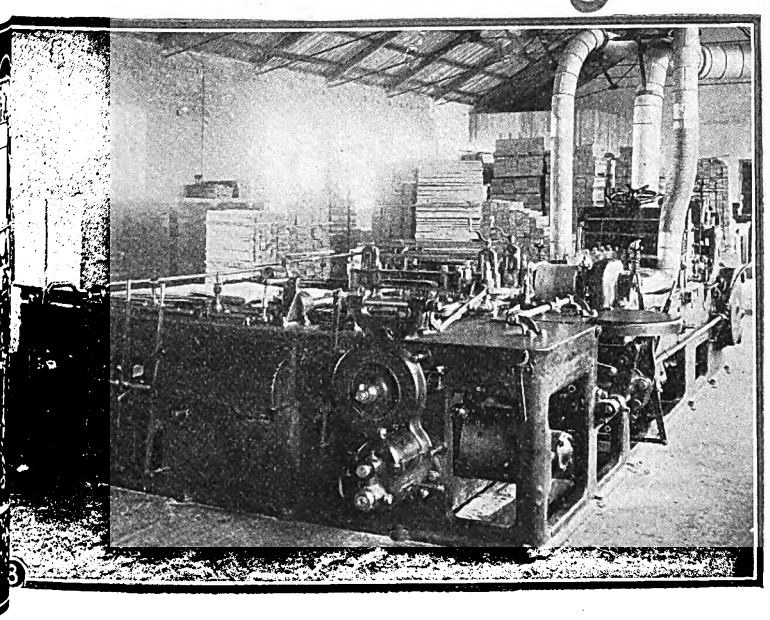


Fig. 9. Sturdy construction is essential for lift truck platforms, which undergo severe knock-a-bout service in daily use.



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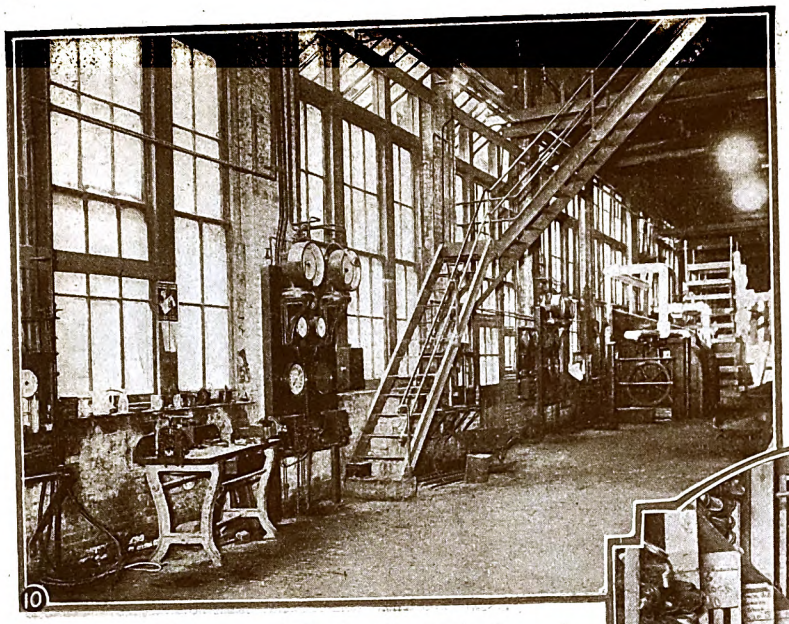


Fig. 10. Stairs should be kept in repair, to avoid accidents, and worn treads should be replaced before they become dangerous.



Fig. 11. The damage done to work on benches by rain, leaking through neglected sash, is more than enough to pay for proper care of such details.



Fig. 12. Cheap in first cost, such storage bins as these often prove more costly in the long run than the portable, adjustable steel bins which have many desirable features.

floor only it is usually comparatively easy to put in extra posts or lally columns in the basement. On the upper floors, however, these extra posts would interfere with machinery, and reinforcing beams are placed at the sides or under the old beams and the columns reinforced proportionally. Good, sound lumber, free from shakes, is the only kind that should be used in any framing work of this kind. It should be seen to that the ends of beams in brick walls are exposed to the air to avoid rotting. The places where decay usually sets in are at the ends of beams and at post caps and beam hangers.

Stairs should be kept in good repair to avoid accidents. Worn treads should be replaced before they go too far. Safety treads frequently become loosened on concrete stairs and they should be grouted in place. Safety treads on wooden stairs can be easily replaced when worn. The wooden floors or decks on bridges are subject to constant wear from trucks and will require frequent attention. Bridges are usually covered with corrugated galvanized iron or some of the asbestos protected corrugated sheets in order to conserve the heat in the buildings at either end.

Stock racks are of two types, the open shelving or closed bins. Up to a comparatively few years ago all stock racks were of wood, but the modern ones are of all steel construction. These steel racks cost more in the initial investment but under rough usage they certainly last longer than wood. They also can be taken down and re-erected as many times as necessary without any injury to the rack. The shelf heights are easily adjustable and intermediate spaces may be put in if desired. On account of the much smaller size of the steel supporting members they hold an appreciably larger amount of goods than wooden racks of equal strength. The adjustable feature is very important when changes in stock requirements are made. Steel racks require little maintenance: the bolts should be tightened up occasionally and the racks should be kept plumb. Wooden racks are apt to have cracked boards and these should be replaced when the break occurs. The racks should be kept well braced if they are heavily loaded and they, too, should be kept plumb. On high racks, ladders on rails are often used. These rails and the fittings on the lad-

(*Continued on page 31*)

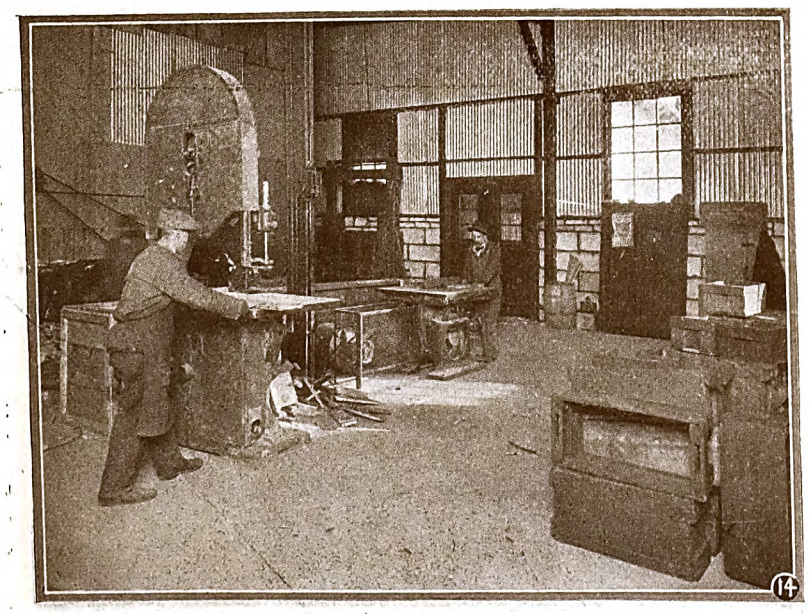


Fig. 13. Work benches require periodic attention, and it is often economic to make only the front part of a bench of hardwood; this being the part on which the actual work is done.

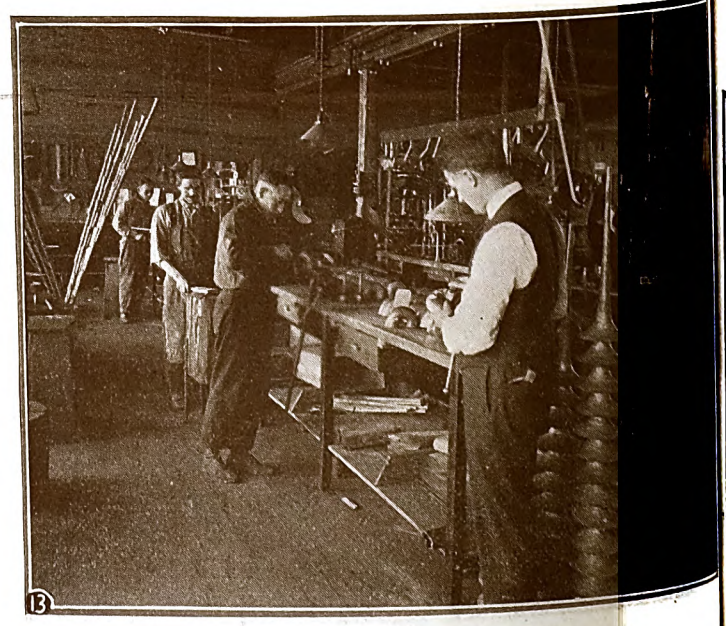


Fig. 14. The plant "carpenter shop" may consist of merely a bench and a few tools, or it may be a fully equipped woodworking shop, depending upon the size of the plant it serves.

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A Challenge to Main Street

Shawsheen Village—A Modern Industrial Community

By Hugo Diemer

(*Director, LaSalle Extension University*)

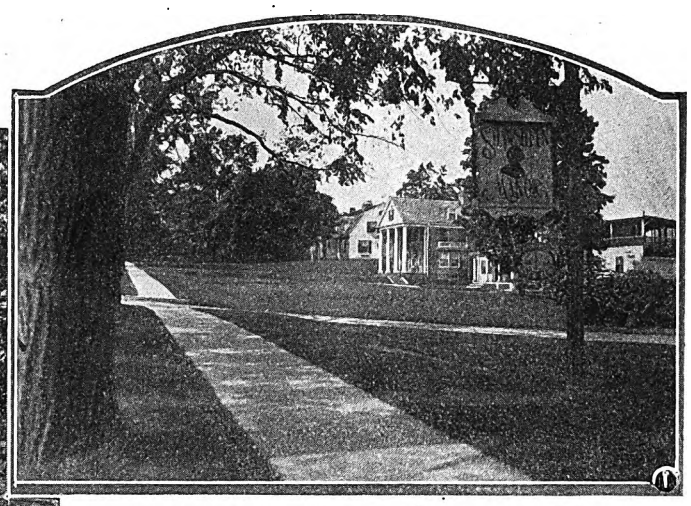


Fig. 1. A typical street in Shawsheen Village. Note the wide expanse of lawns and the careful spacing and setting.

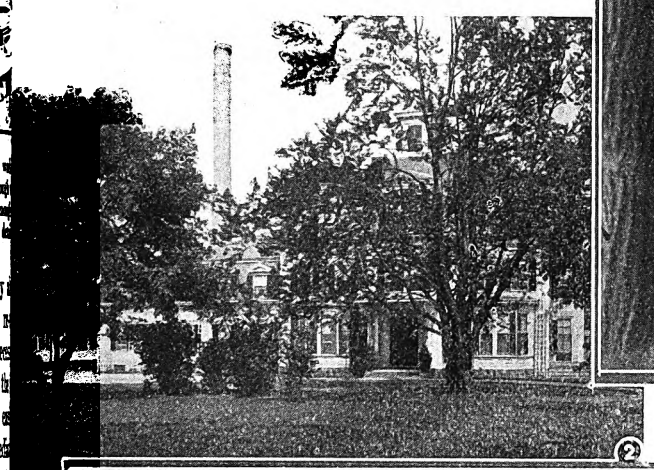


Fig. 2. The Shawsheen Manor, an excellent tavern which is patronized not only by local people, but by tourists from near and far.



Fig. 3. The Balmoral Spa Building. The ground floor is occupied by a splendidly furnished and stocked pharmacy, candy store and soda fountain. The upper floors are rented as business and professional offices. At the right of the building, not shown in the photograph, is a spacious outdoors, cement and waxed dancing floor.

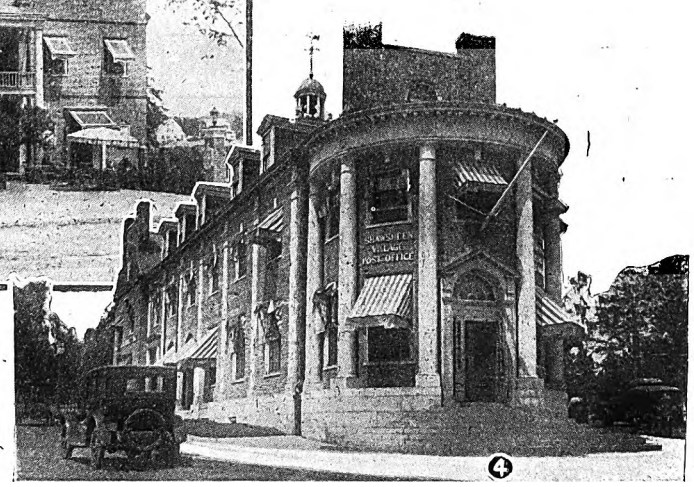


Fig. 4. The Shawsheen Village Post Office. Note the fine colonial lines fitted to modern architecture.

During the War it was the writer's fortune to be assigned to the position of Officer in Charge of Army Work in Lowell, Mass., and vicinity. Business trips and Sunday recreation drew me to travel, occasionally, the old Reading Turnpike to Andover, a delightful drive past many of the finest types of old New England homes characterized by the thoughtful attention of their occupants to trees, lawns, hedges, shrubbery and gardens.

It was only natural that, five years later, while touring New England, I should follow this old turnpike once more. What was my surprise when I entered what, to all appearances, was a beautiful, old-time village of which there had not been a trace when I passed over the road five years before. Naturally, I stopped off and made inquiries and found that I was in Shawsheen Village, one of the best conceived and carried out plans of community development in connection with an industry, where the American Woolen Company has created a beauty spot that stands as a model for projects of this nature.

Since company housing of employees had its beginning in New England, where the pioneer manufacturers erected their mills near water power, it is only natural that the development of housing to its highest state of perfection might be

(*Continued on page* 61)

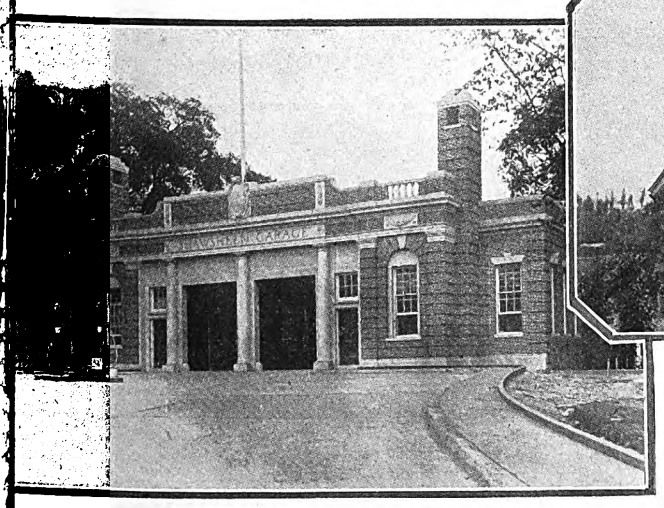


Fig. 5. Shawsheen Garage. A type that might well be copied by prosperous garage owners elsewhere.

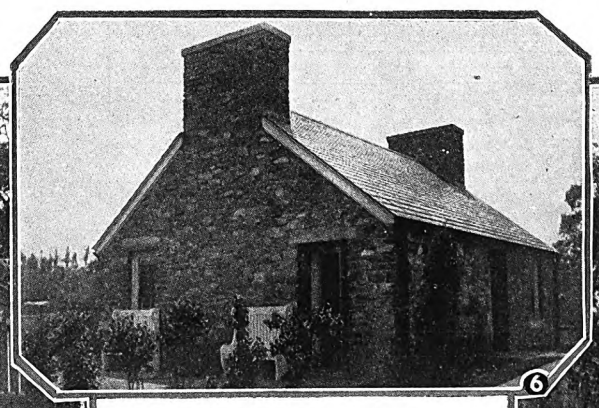


Fig. 6. The Boys' Club. Note the attention to fine, artistic detail in planting and outdoor furnishing.

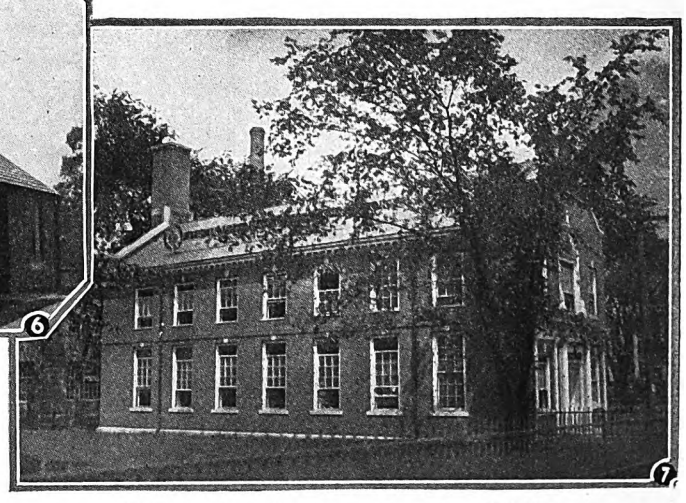


Fig. 7. The Shawsheen Laundry Building. Another example of providing a handsome building with fine setting for an institution which is apt to be an eyesore.

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Minimizing the Invest

How the General Electric Company

By John

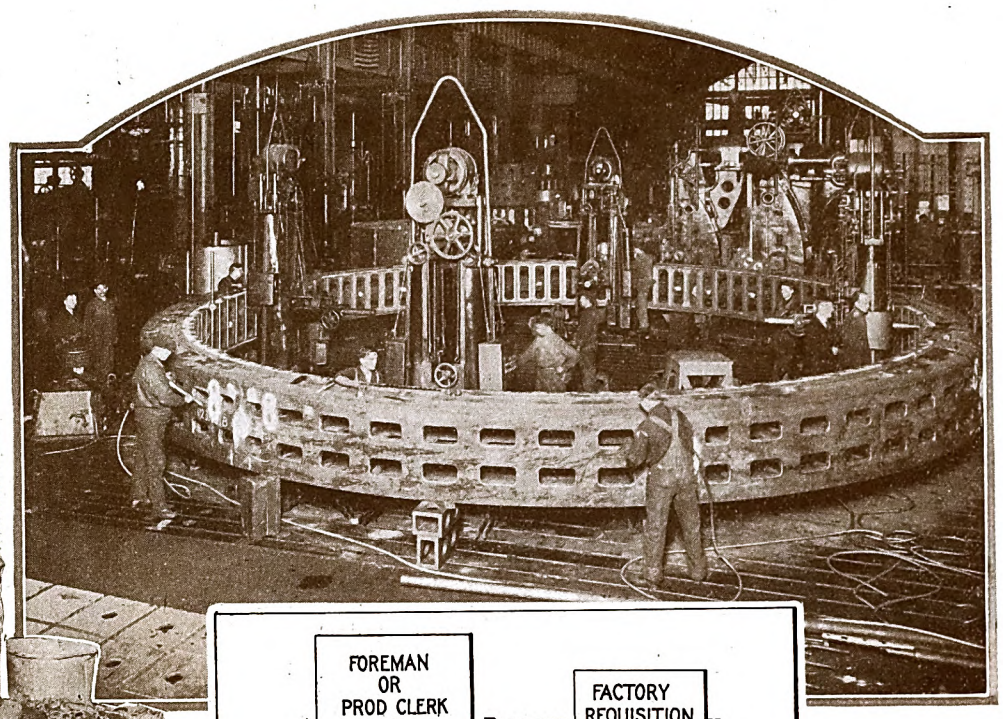


Fig. 1. Extreme variety reigns supreme at Schenectady. This huge generator casting represents one extreme.



Fig. 2. The potter's wheel of Pharaoh's time is in daily use in molding porcelain insulator bushings.

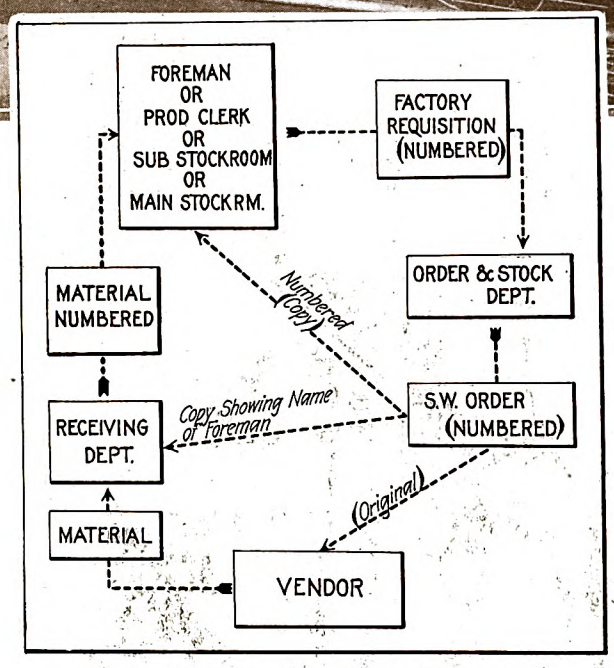


Fig. 3. Above is a diagrammatic outline showing the general routine in the cycle of raw material ordering and delivery.

Requisition No. I- 100 Approved

to

STOCK DEPT. CHECK	WANTED	PROD. DEPT. CHECK

For Shop Order No. Symbol the following:

QUANTITY	DESCRIPTION OF MATERIAL

Deliver to Bldg. Door

Signed

FOREMEN AND PROD. DEPT. ARE REQUIRED TO FILL OUT THIS FORM

Apparatus due for shipment

Consumption past 3 months

Quantity on hand

Quantity required Weekly

First Shipment should reach Factory

Ordered 19 Requisition No.

Of

HURRIED

DATE	BY	DATE	BY	DATE	BY

SW-117 500 blks (100-2) 5-3-23

Fig. 5. The original requisitions come from various parts of the works and are sent to the Order and Stock Department.

MATERIAL

DESCRIPTION

USED FOR STORED

Dept.	Shop Order No.	Foreman's Order No.	Date	Quantity Ordered	Remarks

Fig. 4. A card record is kept of all requisitions for standard materials in the form shown above.

SW-623 10m 4-6-23

S.O. No. Type

Form Eng. No. D. List

Schedule Req. No.

Held Up Released Cancelled

Completed Issued by Date 192

DEPT.	FOREMAN'S ORDER NO.	DATE	QUANTITY ORDERED	MATERIAL	DESCRIPTION	REMARKS

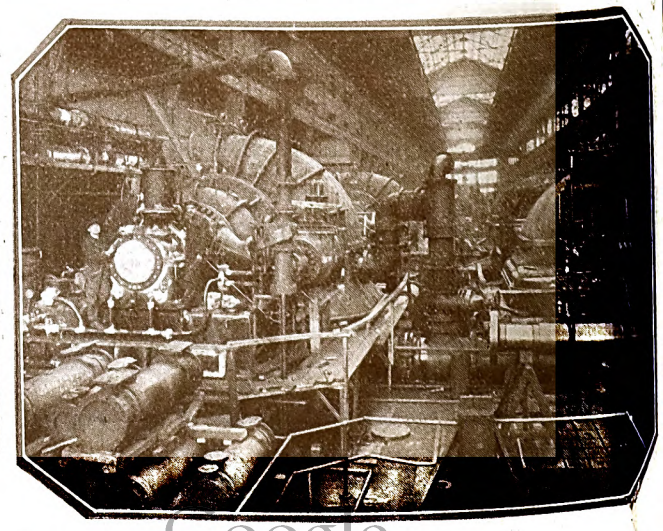
Fig. 6. A shop order record is also kept on which the requisitions pertaining to every order number are listed.

SINCE the war and its economic after effects have ushered in the new period of higher price levels, much attention is being paid to inventory control. Many examples can be quoted of successful profit building through curtailment in investment in raw materials. The first requisite to the minimizing of this investment lies in intelligent ordering.

Perhaps in no other plant does this matter assume more importance than at the General Electric Company's Schenectady Works. It is sufficiently difficult to devise an efficient raw material control system for the ordinary plant with a limited number of products and a small variety of materials. Imagine then the problem that obtains at this plant where the products embrace an almost infinite variety, from microscopic X-ray parts, to huge turbo-generator units of 60,000 horsepower. Here the raw material list runs the gamut alphabetically from Aluminum to Zinc, and in value from pig iron to platinum.

At. Schenectady, the routine of ordering and tracing is under the jurisdiction of the Order and Stock Department, which is the connecting link, so to speak, between the Production Departments and the Purchasing Department. The Order and Stock Department receives requisitions from the factory for materials and purchased supplies required, approves and transmits these to the Purchasing Depart-

Fig. 7. Below is a view of one of the main bays in the turbine department. Enormous quantities and varieties of materials are required here.



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ment in Raw Materials

Handles Its Ordering Routine

HERBERT

ment and after the orders are placed assumes responsibility for the delivery of such materials when and as required.

A composite picture of the high spots in the routine employed by this department is depicted on these pages. So efficient is the system that is employed and so effectively is it operated that it is very seldom that production is delayed because of lack of suitable raw materials. This statement takes its proper emphasis when it is understood that the Schenectady Works comprise some twenty or more different factories, that the materials involved run into millions of dollars per month and that every precaution is exercised to prevent overstocking.

Quantities handled under this routine annually form a prodigious total. In the wire drawing and cable insulating departments, copper must be provided for nearly one hundred billion feet of wire and cable. Some fifteen thousand switchboard panels, thirty-five thousand induction motors, ranging from ten to two thousand two hundred horsepower, eighteen thousand controllers per year, tens of thousands of X-ray tubes, and thousands upon thousands of other items in similar impressive quantities comprise an aggregate which represent over one hundred thousand shipping orders and fifteen thousand cars loaded per year. The shipping department alone uses fourteen million feet of lumber a year and a ton and a half of nails a day.

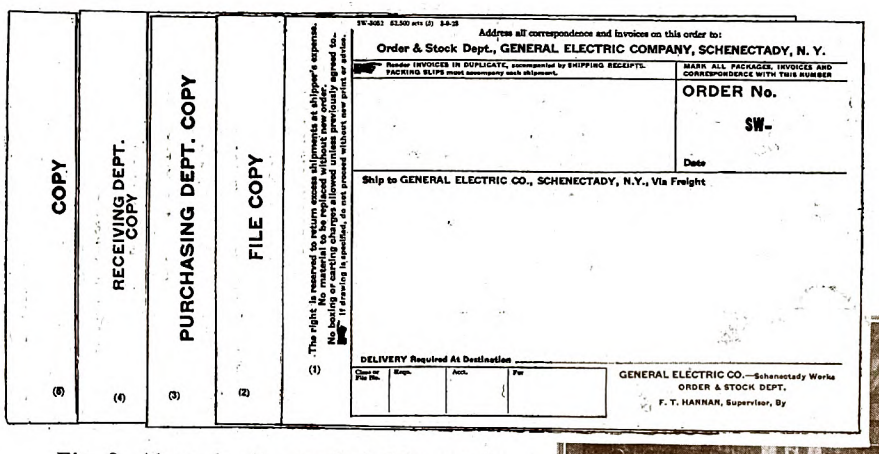


Fig. 8. Above is the standard Schenectady Works Order Form which is sent to the vendor. Copies are distributed to departments concerned.

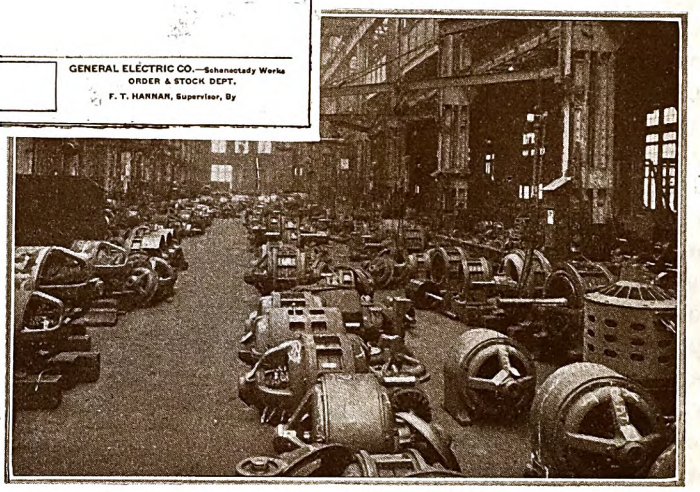


Fig. 9. At the right is one of the smaller motor departments. More than one hundred different materials are required in the construction of an electric motor.

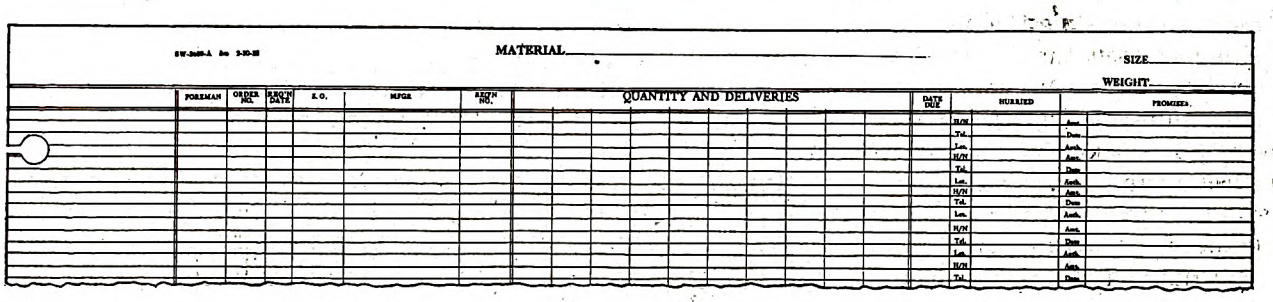


Fig. 10. Ledger sheets are maintained for materials for which there is a general call and are used for tracing purposes.

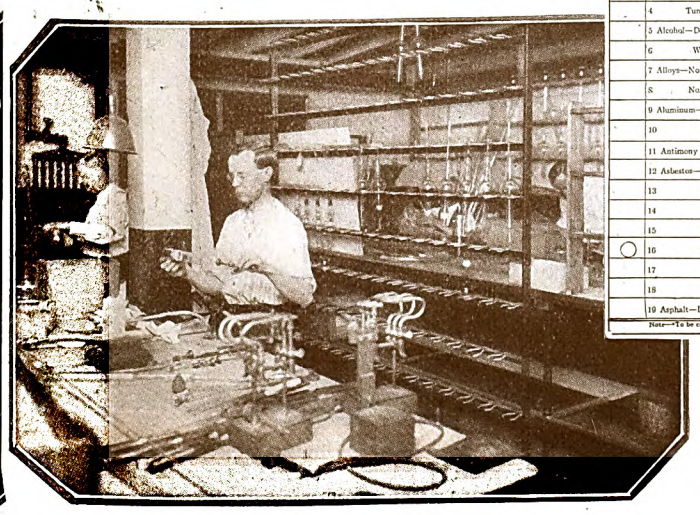


Fig. 11. Below is a view in the X-ray department where glass, tungsten and rare materials are required.

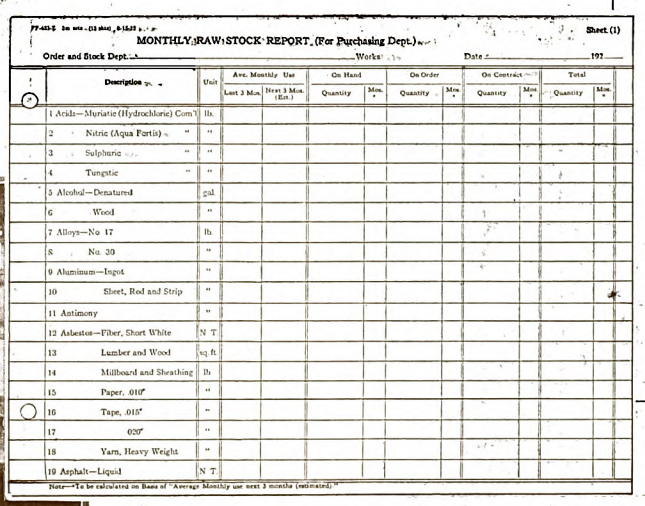


Fig. 12. Monthly reports of raw stock comprising 228 numbered items are made to the Purchasing Department.

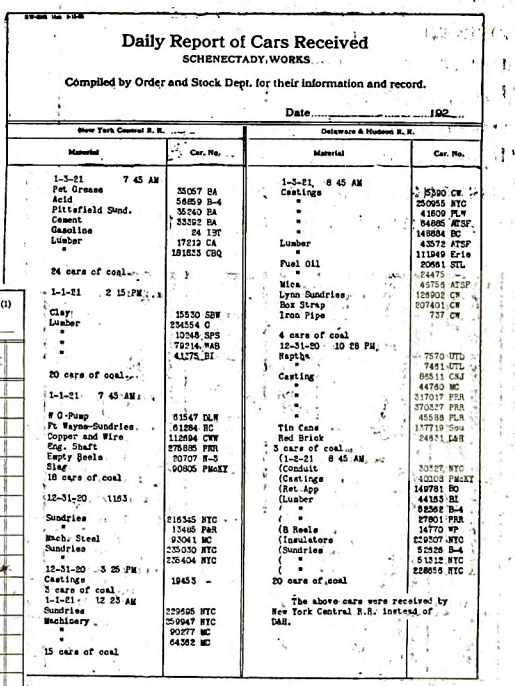


Fig. 13. A daily report of cars received is compiled and distributed by the Order and Stock Department.

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Patriarchal Versus Modern Shop Management

By James Wade Russell

THE writer of this article has been active in the industrial world for twenty years. He has been a machinist's apprentice, machinist, toolmaker, gauge-maker, foreman, superintendent and a teacher of mechanical trades and semi-trades, he has been and done practically everything in a manufacturing plant from sweeping the floor to managing the shop and the help.

He believes that his varied contacts and personal participation in manufacturing affairs have not destroyed his sense of proportion, or blunted his perceptions, or his appreciation for the advancement made in industry, as he is still active and knows the labor situation from the "green hands" to the skilled workers, as it exists today in our American industries.

He has seen these American industries completely revolutionized during the past twenty years, has associated himself with the men, foremen, superintendents and managers, and therefore he is in a position to know what is lost to our industries today and the remedy to overcome that loss through the mentorization of the personnel of our industrial institutions.

What is it that has been lost to modern industry?

Why is our labor restless, shiftless and dissatisfied?

In grandfather's day the "master" taught the boys how and why, but today the "master" is lost.

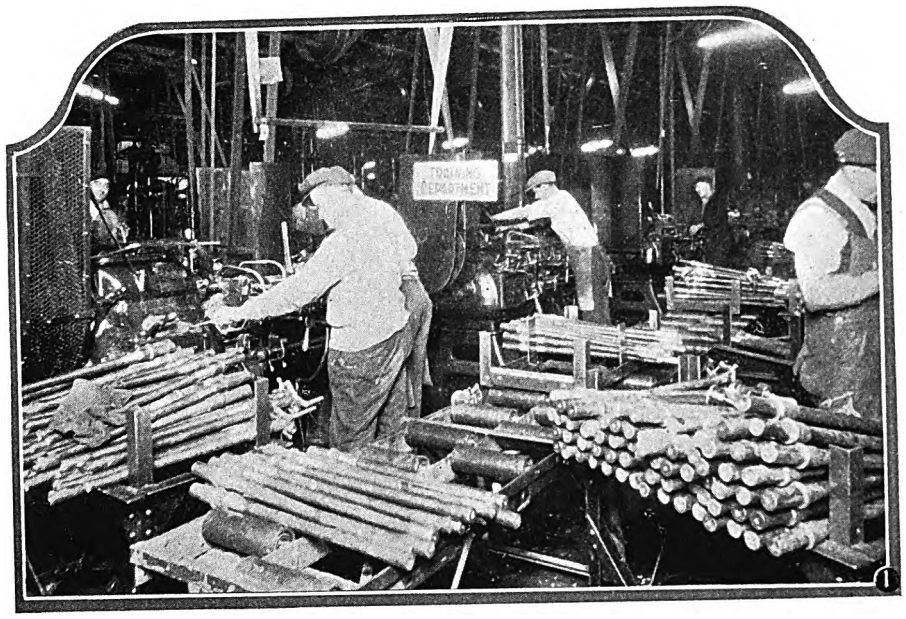


Fig. 1. It is usually advantageous to put the training section near the regular production work, as is done in the above instance.

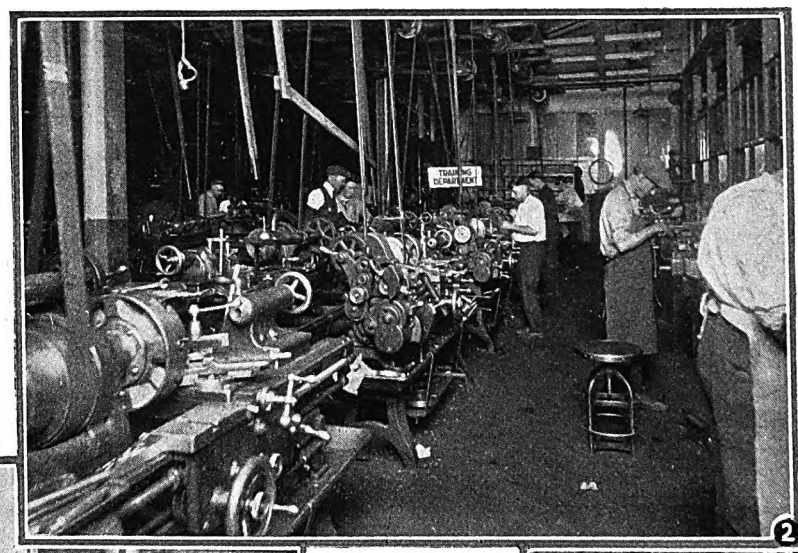
Due to the rapid development of our large modern plants we find the "head" so far removed from the "man" that the contact is through an absent treatment method. The success of a plant's economical producing depends largely upon the information brought to the boss by subordinates, who do not always carry a true picture of the subject.

Managers are at a loss to understand why men become dissatisfied and quit; this causes them to set up "fences" in order to learn the cause, and then very often they see their plans go astray, because of the entrance of shop politics, or the inefficient working out of the system thus set up, which leaves the managerial heads more doubtful than before.

Years ago, when the Patriarch inducted beginners into his shop, he was very painstaking; learning all about the man's habits, ambitions, family connections and all other vital matters he wanted to know. There was a thorough and mutual understanding between "the party of the first part and the party of the second part."

Written agreements were worth the paper they were written on, and the boy's father and the master saw to it that the agreement was carried out. But

Fig. 2. Occasionally, where machines of one kind are scattered about the plant, the training for this kind of work has to be centralized—as shown below in the Willys-Overland plant.



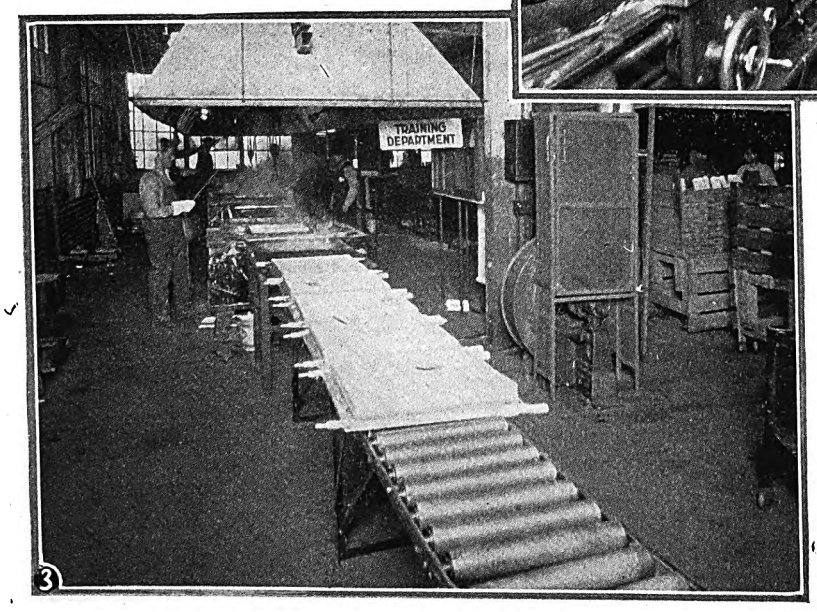


Fig. 3. On radiator making, where operations run into the hundreds, the training section is centralized, adjacent to the main shops.

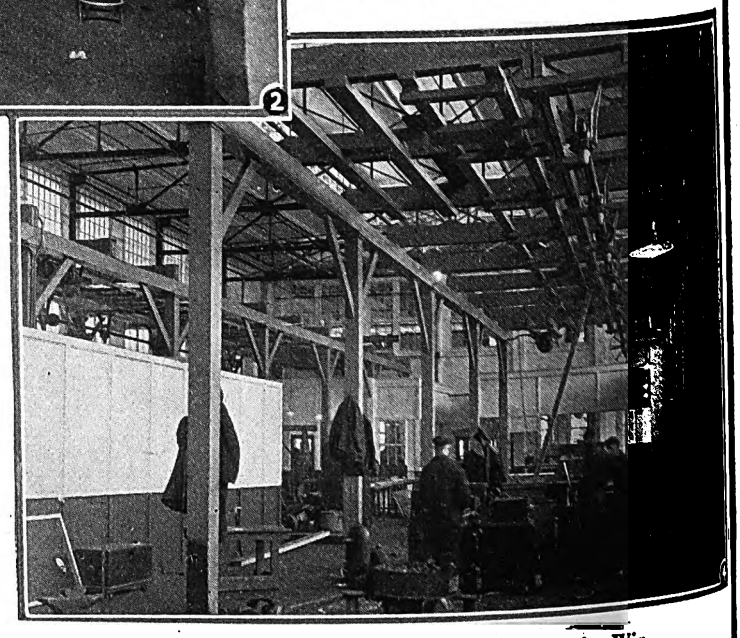


Fig. 4. Training electrical wiremen, at the Winchester Repeating Arms Co., involved some knotty problems.

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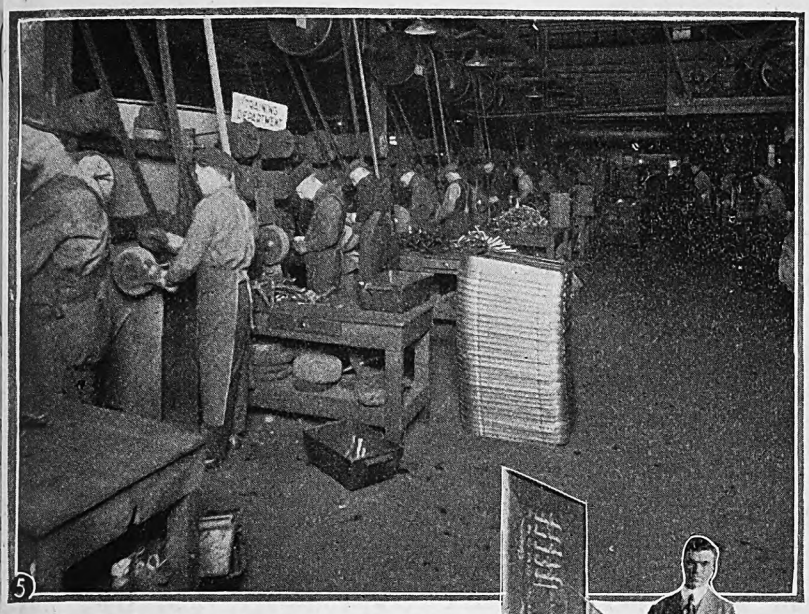


Fig. 5. Training department for polishers, adjacent to the production department.

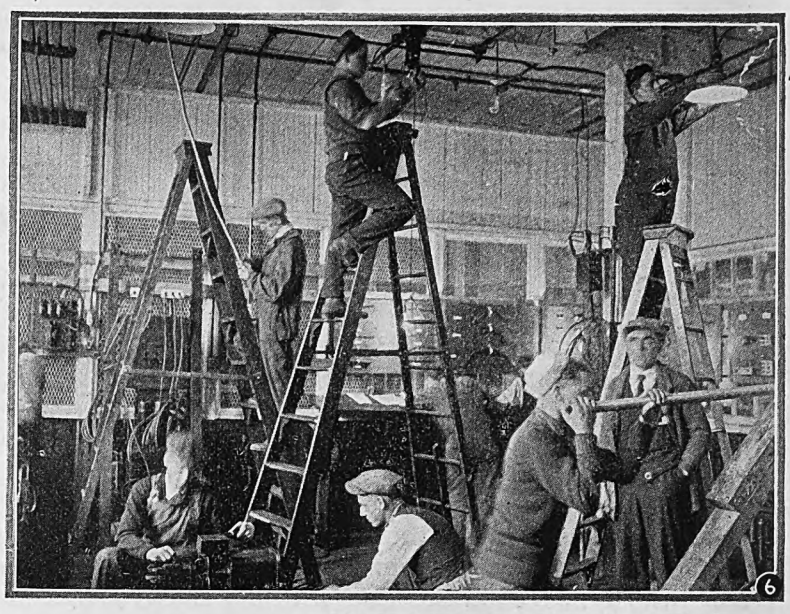


Fig. 6. A "laboratory" for the training of electrical wiremen, Winchester Repeating Arms Co.



Fig. 7. Academic training in Company schools, to supplement the practical instruction.

today the "master" is lost. Neither parent nor boss gives a "tinker's dam" about the boy or his welfare, resulting in the pitch-forking of labor into our shops and plants, and the terrible unrest caused by not fitting the man for the job, or maybe the job for the man.

Daily, men call at the employment offices of our plants, and while waiting for an interview, become "educated" by the mob; learning how things stand today; what are the best paying jobs, and all the other "dope" about the plant that the gang usually hands out. They have no master to guide them but are swayed and influenced by the "mob key man," who is always present.

The Patriarchal master is lost to industry today, and a substitute must be found if harmonious labor relations are to be permanently established.

"Training on the job" is the substitute being used by some of our industrial managers today. Careful selection, guidance and training is the answer if we are going to fill the void left by the loss of the Patriarchal master.

We are all familiar with the results of one day's hiring at the average plant when labor begins to get scarce; ten per cent. hire out but never return; fifty per cent. that starts to work, quit cold the first day; one-half of those left, hang on for five or ten days and then "blow." The balance, that remain long enough for a fair trial, usually find conditions as represented and make good workmen.

Let us concentrate on the foregoing a moment. Some will say, "we are all familiar with the situation, but what is the answer, the way out?" By reading carefully you will learn how the turn-over in a large plant was reduced from 98 per cent. to 46 per cent. in two months and is still going down

(*Continued on page 75*)

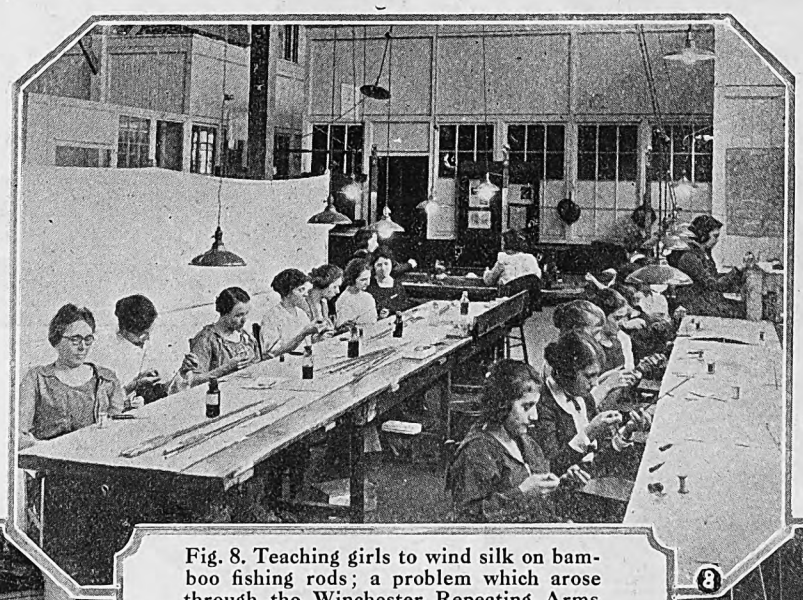


Fig. 8. Teaching girls to wind silk on bamboo fishing rods; a problem which arose through the Winchester Repeating Arms Company's making new products.

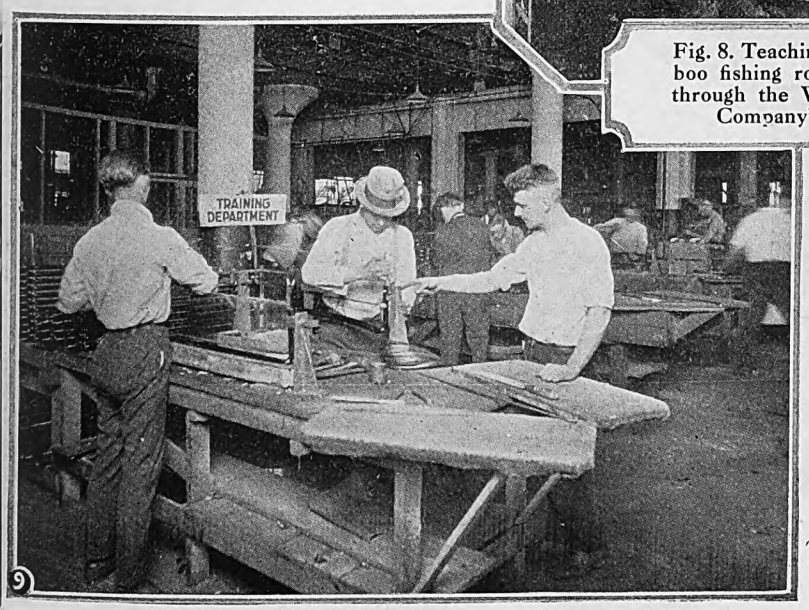


Fig. 9. Training future workers in the intricacies of windshield assembly, at the Willys-Overland Plant.

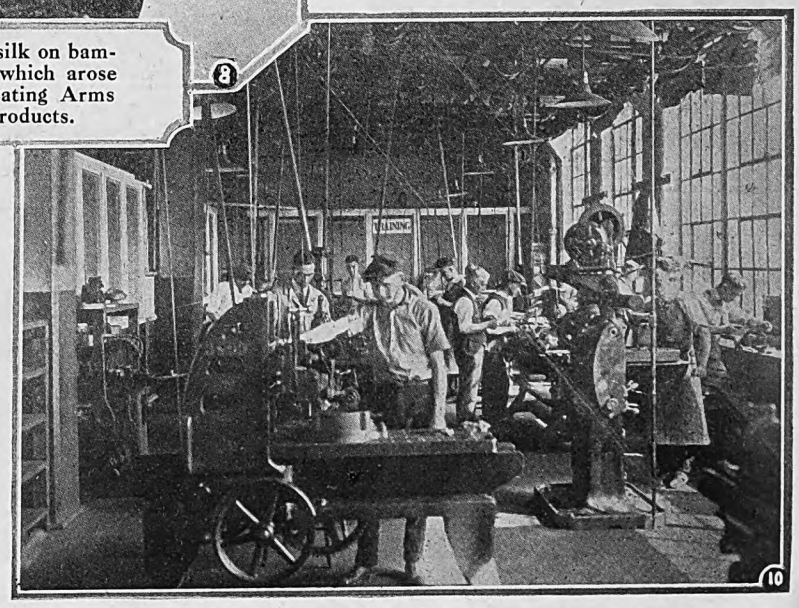


Fig. 10. Re-Training toolmakers who were rushed through the training during the war emergency.

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Helping to Solve the Nation's Transportation Problem

By Matthew W. Potts

IN the February issue, car loading and unloading devices were described in order to show the methods of immediately releasing railroad equipment so that it could again be put into transportation service. There is, however, a new factor which has entered into the science of handling and transporting materials, namely: the motor truck and its accessories.

During the years 1916-1918, motor transportation developed very rapidly, and today the commercial value of the motor truck has advanced far beyond the knowledge of the proper way to use such equipment. The result is that many installations of this equipment are wasteful and represent a loss which could easily be turned into a saving.

In the case of production equipment, it is always considered essential that the equipment be kept continually busy, as idle time represents expense. This axiom also applies to motor trucks and it is therefore necessary to have accessories or auxiliar equipment to facilitate the loading and unloading of trucks, to increase their carrying capacity, and to make them interchangeable with and applicable as a part of, the present transportation systems.

On the loading of bulk materials from storage piles, we still find shovel gangs employed for loading the motor truck, and yet many companies are manufacturing portable loading equipment to perform this operation. Fig. 1 shows such equipment operating in a gravel pit on the loading operation. While it is necessary for men to shovel the gravel to the conveyor, the reduction in labor costs by its use is approximately 50%, as two men are employed instead of four, but the most important saving is in truck time, which amounts to about 33%. This item of 33% is figured if the trucks come on schedule time, but frequently the saving is more as the trucks will arrive at the pit in groups of two or three.

Some companies have found that the loading speed of this equipment is more or less governed by the men shovelling to the conveyor, and they have gone further in making the loading operation entirely mechanical. Fig. 2 shows a self-propelled, self-loading portable elevator which eliminates all shovelers, and is operated by one man. In the illustration a man is shown on the truck with a shovel, but if coöperation can be obtained from the chauffeur, this man whose duty it is to trim the load on the truck can be dispensed with. It has been found in actual practice that the self-loading portable elevators have reduced loading costs about 66%, and have made a saving in truck loading time of over 50%.

While the above equipment is separate and apart from the motor truck, there are many special appliances which can be attached direct to the truck, in order to make it more valuable. Among these may be mentioned power winches, which are used to aid in the loading and unloading of heavy objects, and swinging crane apparatus used to remove heavy objects from the truck platform, and on other operations.

A truck equipped with a power winch can be quickly loaded, and it is not necessary

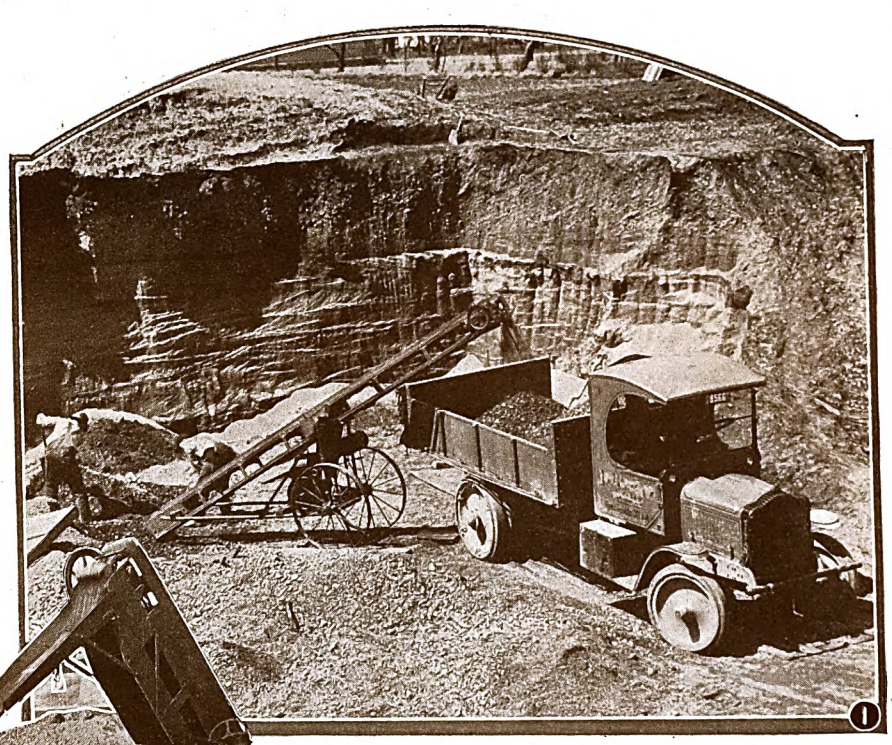


Fig. 1. Loading motor trucks under the above conditions with the ordinary shovel gang is expensive. The portable belt conveyor reduces loading costs.



Fig. 2. A self-propelled, self-loading bucket elevator, which reduces loading costs still further.

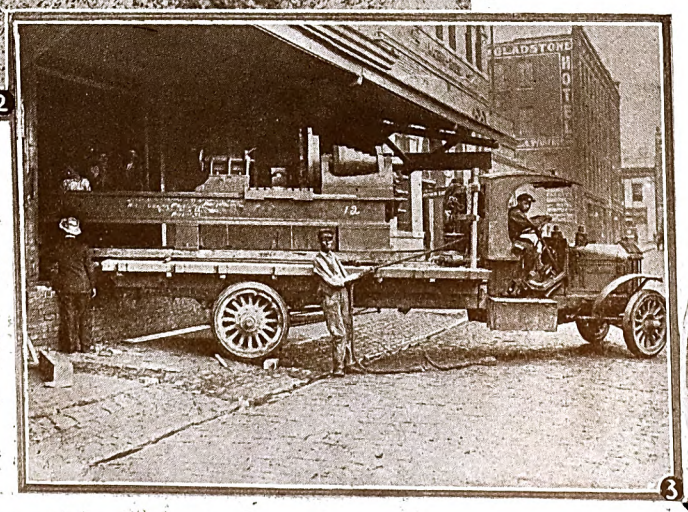


Fig. 3. Loading heavy machinery by hand power is slow and expensive. Let the motor do the heavy work.

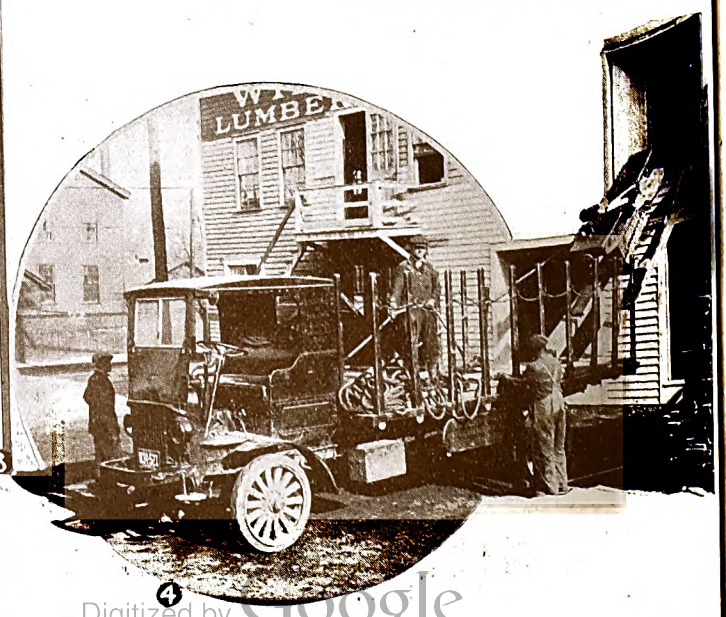


Fig. 4. Unloading to second story without the power capstan would require at least 10 men.

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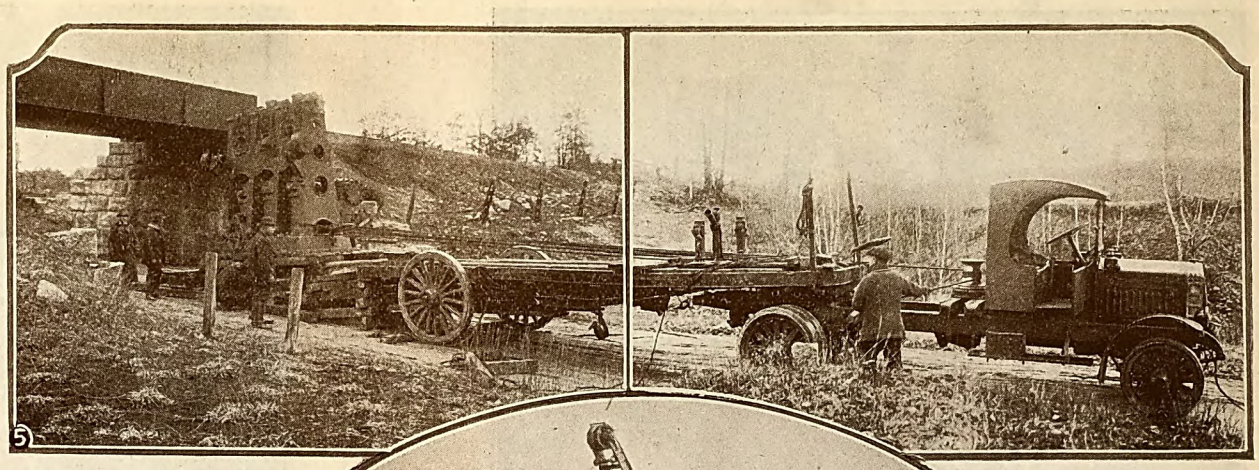


Fig. 5. Transportation is becoming a science, and mechanical power should be used wherever possible.

carry along extra men or a gging gang to accomplish the sults shown in Fig. 3. In the se of Fig. 4, however, where a aner or other heavy equipment being unloaded to the second or of the building, it is fre- ently necessary to have extra en for placing the planks, fast- ing the snatch blocks, etc. The wer winch, however, elimi- tes the slow, heavy labor of lling the equipment up by nd, and as the power is de- ved from the motor engine, it uniform and speedy, thus re- cing the unloading time and rmitting the truck to haul ore loads per day. Many ucks owned by telephone com- nies, general hauling con- rns, wreckers, and industrial ants are equipped with these vices.

Fig. 5 illustrates the value of oper equipment for motor ansportation. In transporting is pump to the industrial ant, it was necessary to do so motor truck. The pump was iginally loaded on to the ailer at the railroad station. had to be unloaded in order to ss under the bridge shown to e left. The power winch was ed at the station, and also for loading at the bridge. The otor truck and trailer was then n forward and planks were id and the power winch pulled e heavy pump under the idge and hauled it on to the ailer.

To those who have handled milar jobs, the savings in time

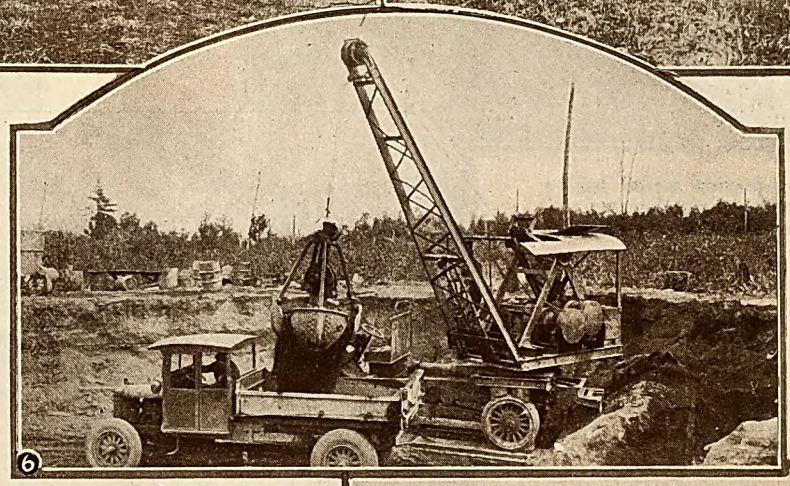


Fig. 6. Crane equipped with grab bucket and mounted on motor truck facilitates quick transportation between jobs.



Fig. 8. Road building and contracting has made many new uses for the motor truck. Dumping direct to concrete mixer speeds up the work and reduces costs.

Fig. 7. This is a heavy crane job, but the truck engine is the only power unit required.





Fig. 9. Quick unloading is essential to bringing about efficient truck operation.

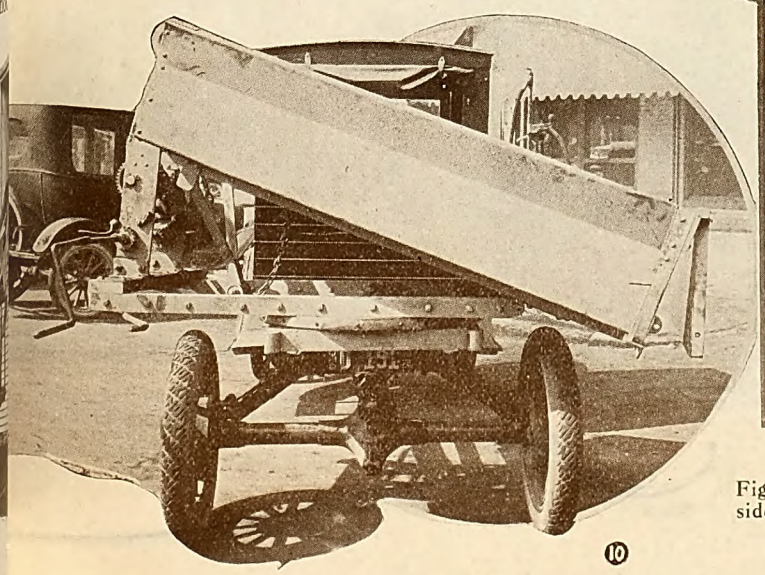


Fig. 10. Turn table bodies to permit side or end dump facilitates unloading in close quarters.

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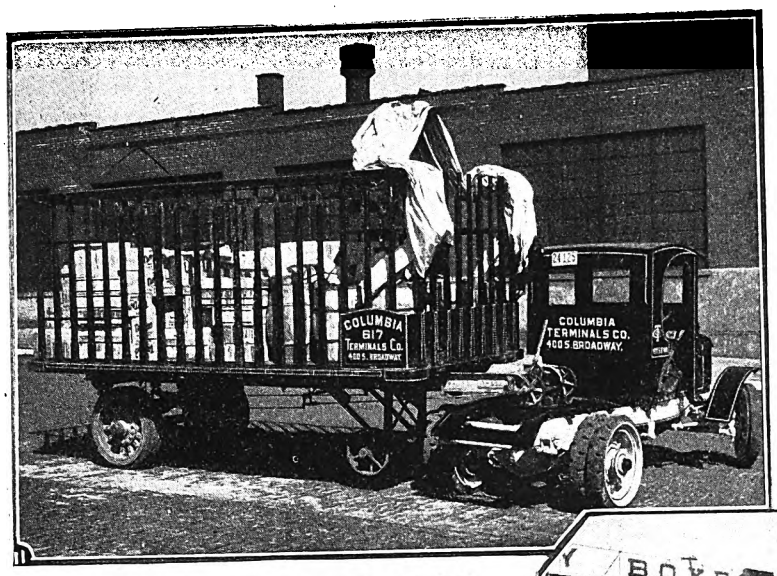


Fig. 11. View showing trailer loaded with miscellaneous merchandise attached to motor truck for city delivery.

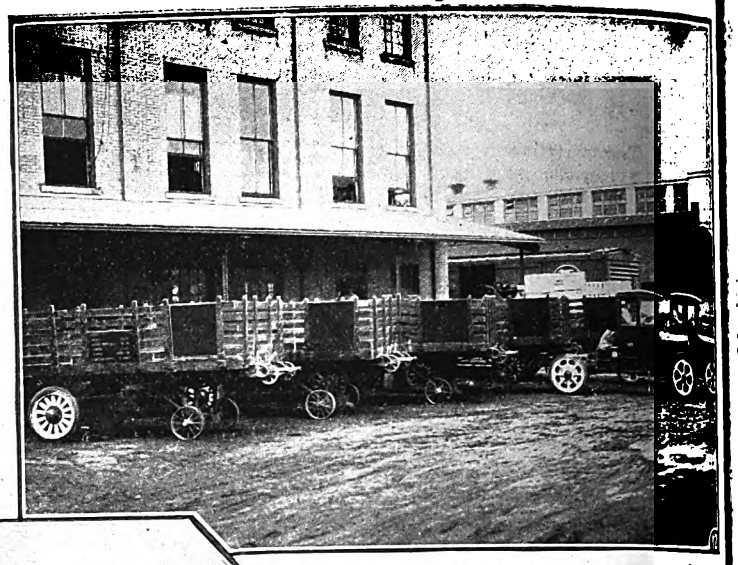


Fig. 12. Loading platform and fleet of trailers operating at the Buick Motor Company, Flint, Mich.

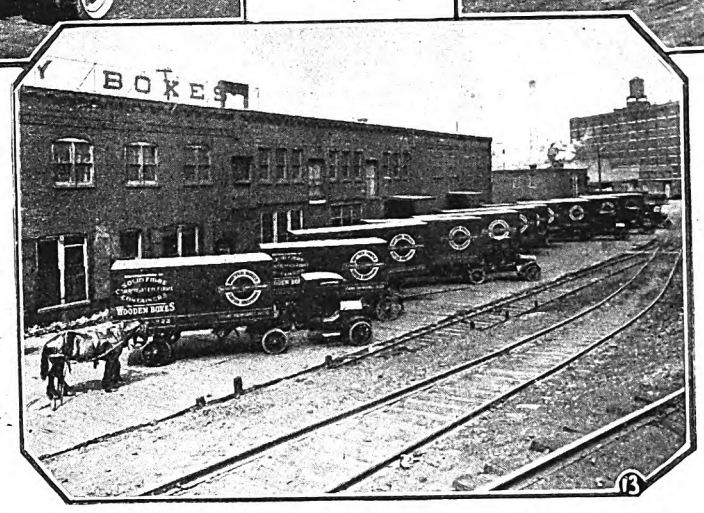


Fig. 13. This fleet of trailers and five trucks are performing the work of 15 trucks.

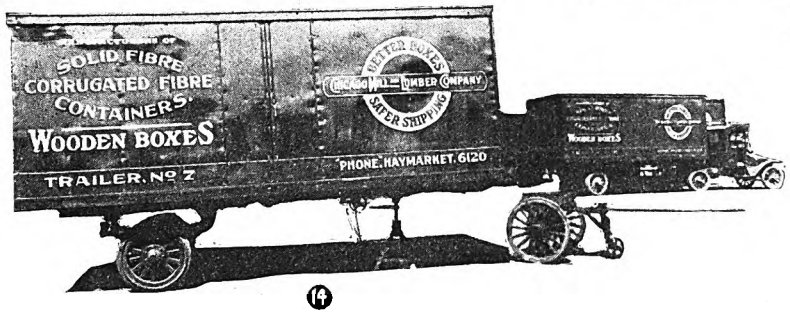


Fig. 14. Close-up view of one trailer shown in Fig. 13, and auxiliary front wheel for shifting trailers without the use of motor trucks.

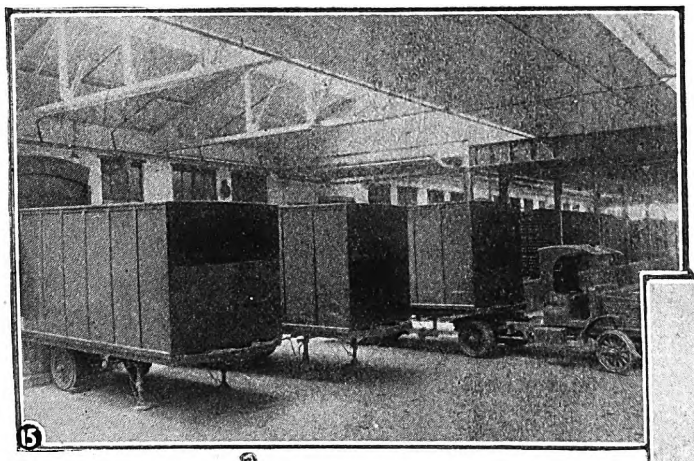


Fig. 15. Different type of trailer operating at the plant of the Western Electric Company.



Fig. 16. A four-ton trailer and 3-ton truck loaded with 12 tons of oranges leaving Lindsay, California, for Sacramento.

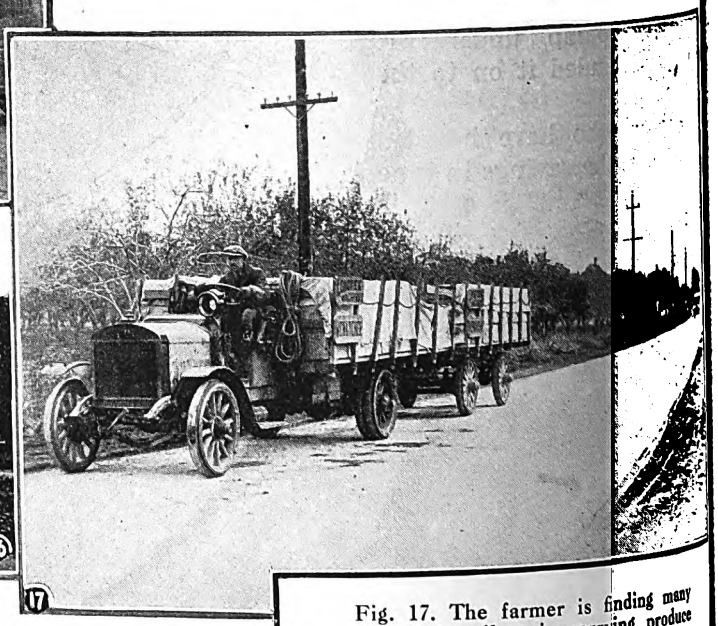


Fig. 17. The farmer is finding many uses for trailers in carrying produce to market.

and money effected by using the power winch instead of hand labor for these various handlings will be apparent without need for explanation.

Industrial plants have not contributed to the development of the motor truck, but they are now profiting by the experience of contractors and others who have made many uses of such equipment. Fig. 6 shows a crane mounted on a motor truck. Such a device would have many applications in a plant yard, etc. The crane in this case, however, is equipped with an orange peel bucket, and is employed by a contractor on road building. Three of these cranes, each handling approximately 550 yards of gravel in a 10-hour day, kept forty motor trucks busy during the past season on road work for one of the state highways. The contractor found that by having the crane mounted on a truck, it facilitated

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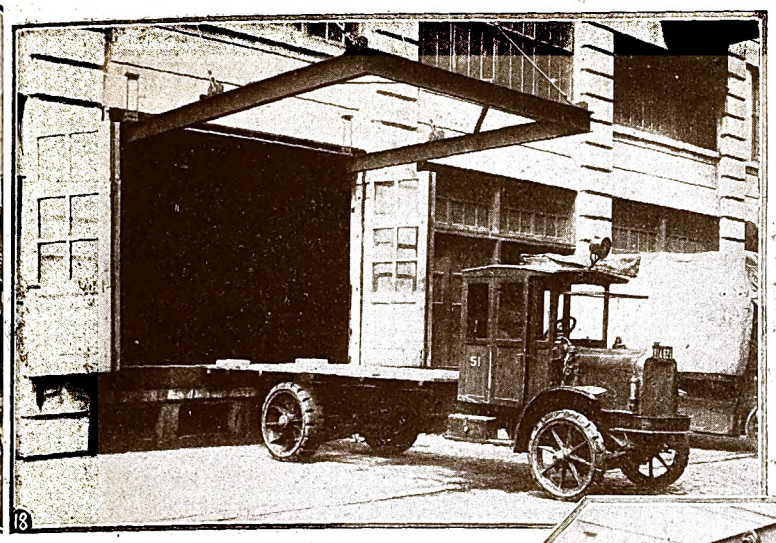


Fig. 18. Motor truck backed into position for loading.

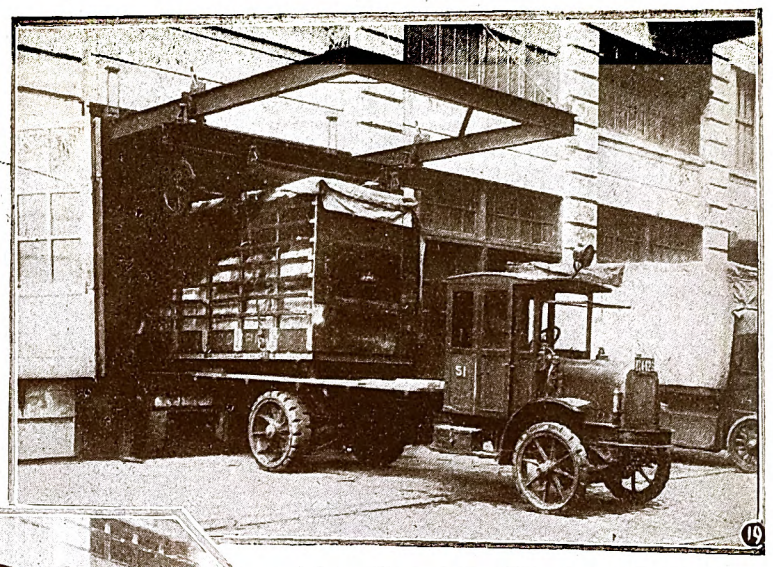


Fig. 19. Demountable body loaded in building being pushed into position on overhead tracks.

quick transportation between gravel pits.

Another type of crane which would be more applicable to industrial work is shown in Fig. 7, handling front truck axles. Attention is called to the outriggers in the center of the truck to relieve the load on the chassis frame. There are many other applications of cranes on motor trucks and some industrial plants, such as cable manufacturers. foundries, etc., have found that this type of equipment has materially reduced their handling costs both about the yard and in the loading and unloading of their delivery motor trucks.

Many inefficiencies in truck operation are traceable to the bodies and the importance of this feature of truck equipment is such that truck manufacturers usually quote on chassis without bodies, thus permitting the truck owner to equip his

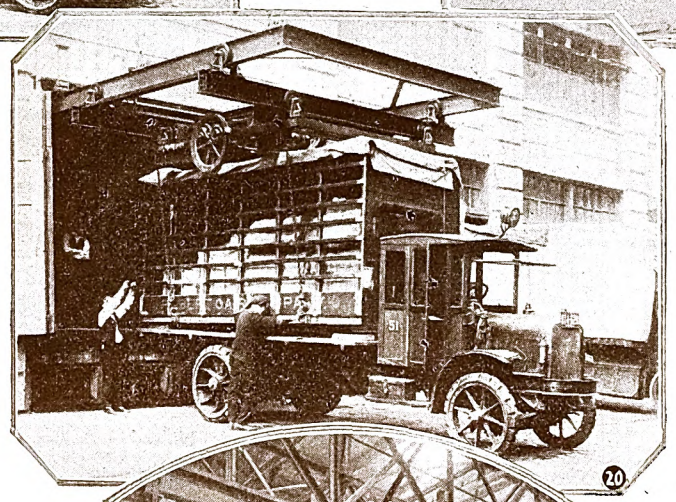


Fig. 20. Full view of body carrying unit and method of loading same to truck.



Fig. 21. Showing demountable bodies in position for loading, where motor trucks back into building. Note the overhead tracks and body supports which permit longitudinal movement.



Fig. 22. Another type of demountable body which does not require overhead supports. One man, by turning hand crank, pulls body into position on truck.

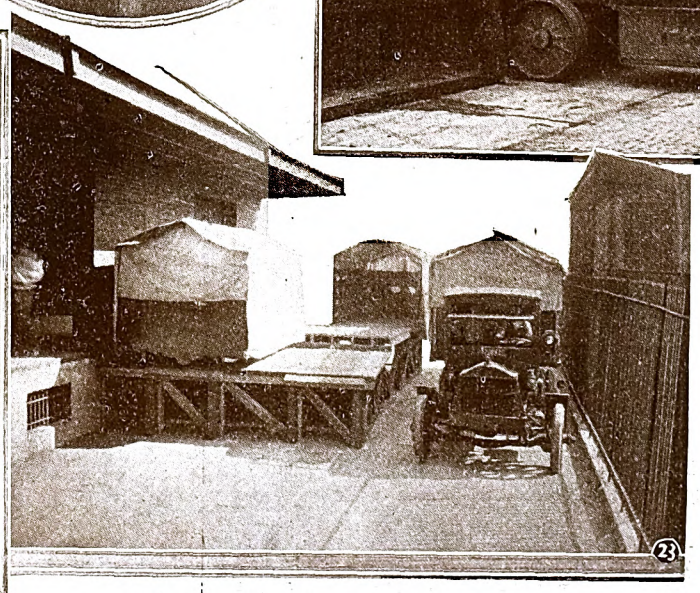


Fig. 23. View showing loading platform where demountable bodies are employed. This company, using two trucks and four bodies for city deliveries, effected savings of approximately 40%.

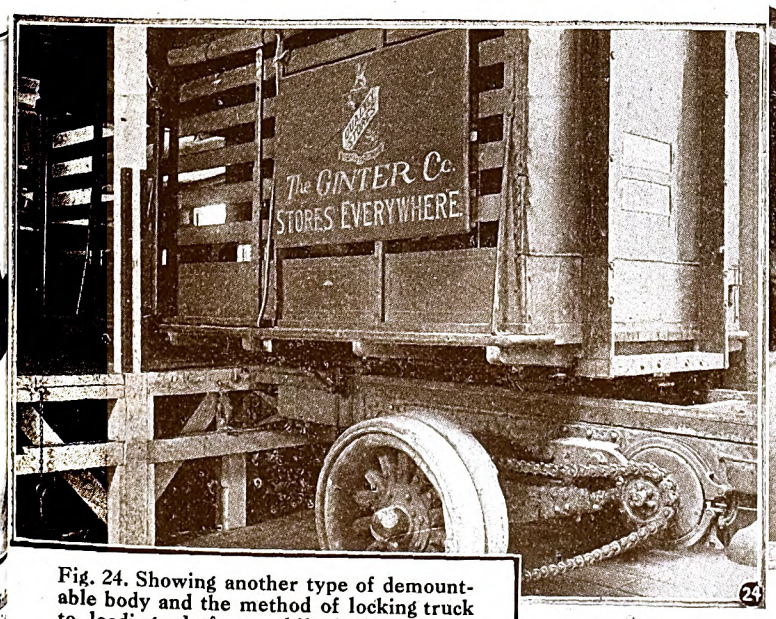


Fig. 24. Showing another type of demountable body and the method of locking truck to loading platform while body is being rolled on to or off of truck chassis.

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Fig. 25. A unit in the Nation's transportation system. Fleet of motor trucks employed in long distance hauling of moving of household goods.



Fig. 26. Same truck shown in 24, showing demountable body locked in position on truck chassis.

Fig. 28. A view of the Detroit United Railway motor truck at platform waiting for reception of demountable bodies. Note alignment of tracks on platform with those on truck. Also mechanical arrangement for pulling bodies on the chassis by power.



Fig. 27. European railroad systems have for many years employed demountable freight car bodies. This car is carrying containers filled with carbide.

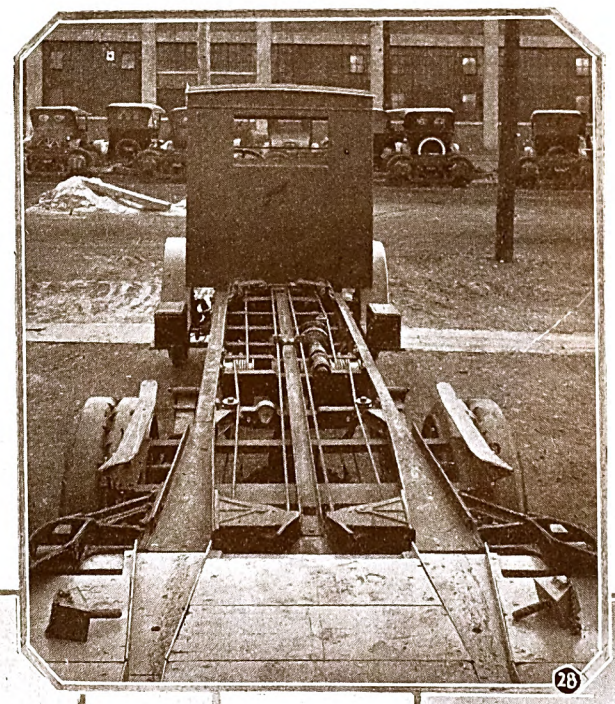
chassis with whatever type best fits his needs. While there are many forms of bodies, they can be classed under the following types, open or express, stake or platform, enclosed or panelled, dump, tank, refrigerator, demountable, and special types. Each of these body types may have many modifications and forms of construction, size, shape and capacity, which makes it applicable for hauling a particular kind of commodity. Each of these forms are best suited to a certain application, depending on the class of commodity and conditions surrounding the installation. For instance, the platform truck can be used to best advantage for hauling heavy boxes and crates, the dump body for loose materials, such as coal, sand, gravel, etc.; the tank body for liquids such as oil and water, and the demountable or special construction under certain conditions.

Fig. 8 shows what is known as a mechanical dump body discharging material to a concrete mixer on road work, while Fig. 9 shows what is known as a hydraulic dump body discharging refuse from a city collecting truck to railroad cars for transportation.

Fig. 10 shows hand operated dump body, which is mounted on a turn table to permit the body dumping at any angle desired. This type of equipment facilitates operation in close quarters and should have many applications in industrial plants.

Plant executives who are operating a number of trucks for delivery between plants or to consumers should give thought to the use of trailers. As previously stated, when operating motor trucks the item of time spent in loading and unloading is often a most expensive one. It is imperative that this lost time be reduced to a minimum. The truck is too costly an article to be used as a loading platform, and should be kept under load

(*Continued on page 42*)



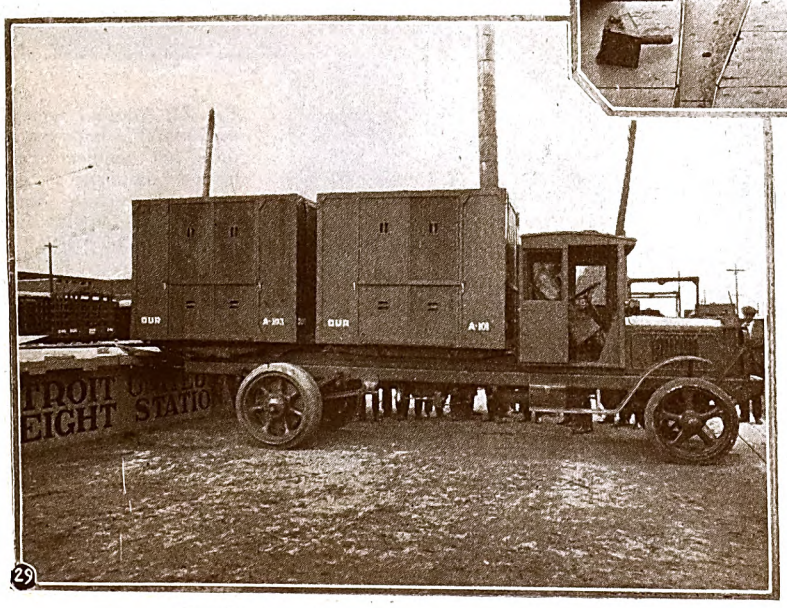


Fig. 29. American railways are now seriously considering the use of similar equipment. This illustration shows demountable bodies being unloaded to the platform of the Detroit United Railway Company.

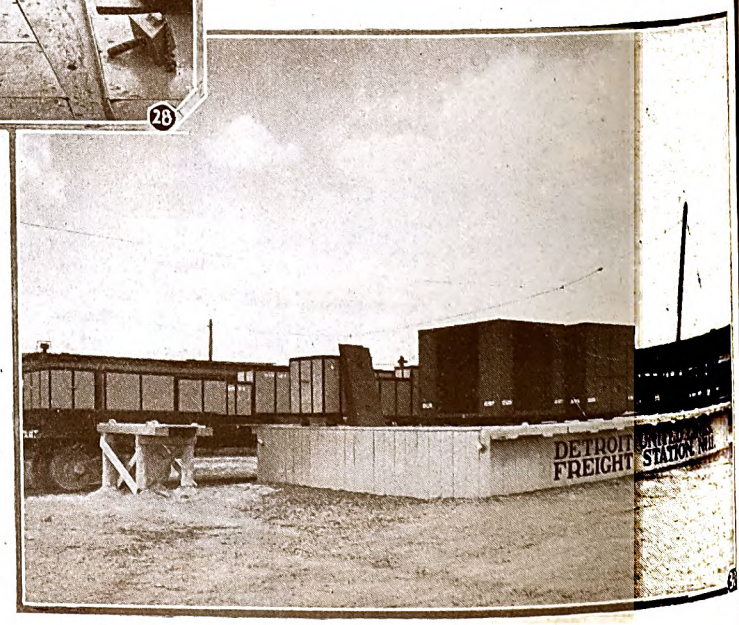


Fig. 30. General view of one of the demountable body container freight stations of the Detroit United Railway Co., showing various types of demountable bodies which are loaded directly on to flat cars or motor trucks.

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Modern Bearings and Their Lubrication Problems

By Allen F. Brewer.

THE vitals of the modern industrial plant, its bearings; the secret of operating efficiency, lubrication. What two factors demand more consideration from the Management? What two factors influence more markedly economical plant operation? Today, regardless of machine design, the manner of equipment installed, or the type of product involved, bearings must be used. They are the heart of the machine, upon their lubrication will depend the rate at which it can produce, and upon their performance under continuous and intensive operation will hinge the matter of machine maintenance and repair costs. Truly, bearings are important in every phase of our daily life wherever machinery is concerned. No wonder, therefore, that every effort is bent to develop them to as perfect a state as possible. Bearings may be few or many, according to the type and function of the machine; in any case, however, regardless of their number they are the salient factors involved in efficient operation.

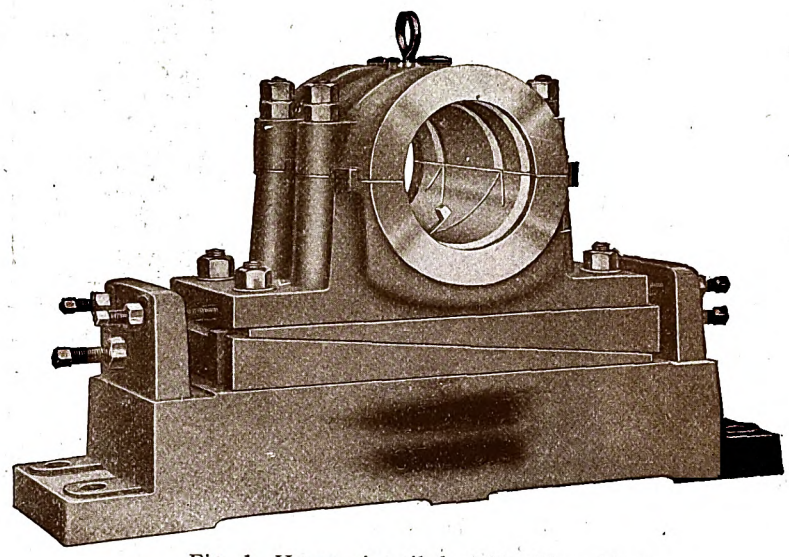


Fig. 1. Heavy ring-oiled rigid pillow block bearing. Note wedge adjusting plate.

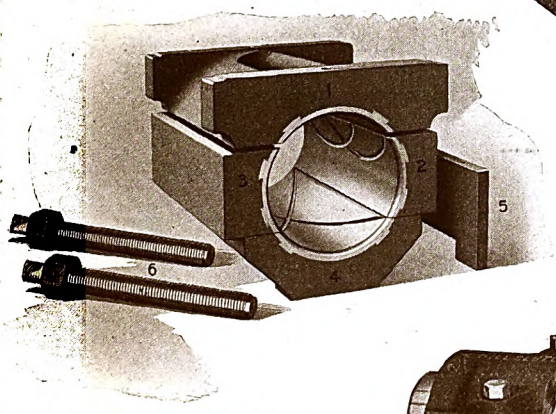


Fig. 2. Details of a four-piece bearing showing the upper, lower and side shells and adjusting screws.

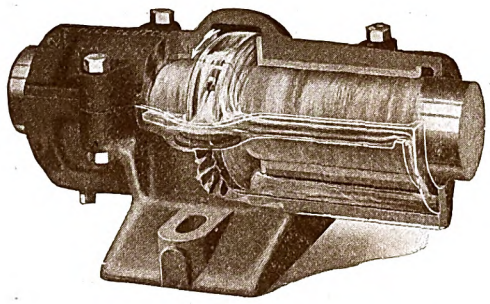


Fig. 3. Collar type of self-oiling bearing showing flow of oil.

Friction and its reduction enters markedly into this problem of bearing operation. To drive a machine, power must be expended in order to overcome the frictional resistance developed by its moving parts, or in other words, between its shafts, journals or slides, etc., and the bearing surfaces which support them. Accordingly, as the speed and operating pressure is increased the resultant friction will tend to increase. It can never be eliminated, naturally, or we might attain the wondrous goal of perpetual motion, but it certainly can be decreased to a decided extent by effective lubrication.

By solid friction, we understand the resistance to motion which occurs when two solids move over one another. This will vary naturally, according to the type of the solids involved. In general it will depend largely upon the smoothness of the sur-

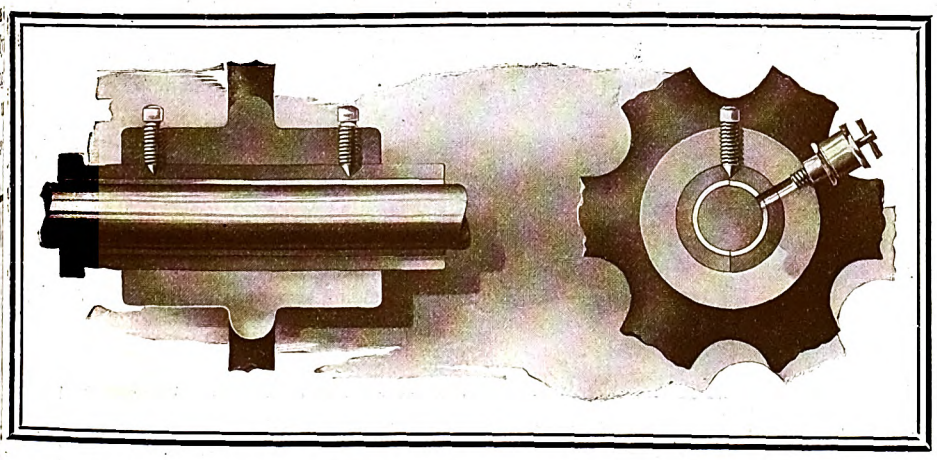


Fig. 4. Split sleeve and bushing as used for friction clutch pulleys. Note compression grease cup installation for lubrication.

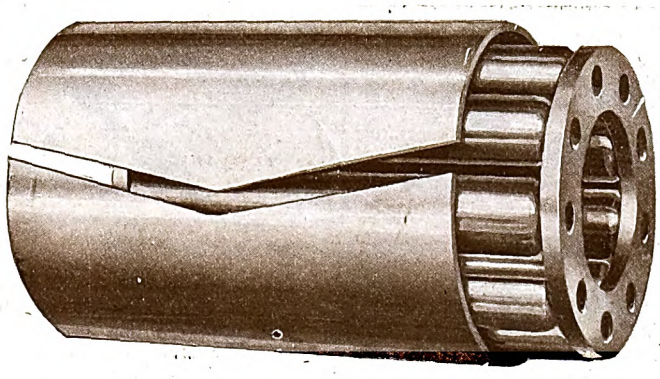


Fig. 5. Commercial type of roller bearing. See details in Fig. 6.

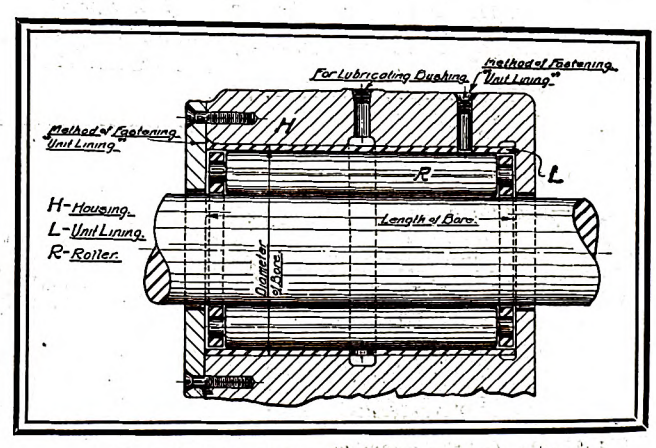


Fig. 6. Details of the roller bearing shown in Fig. 5.

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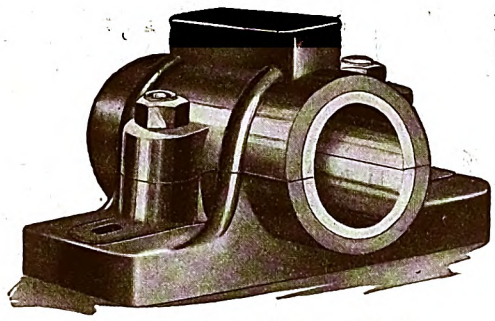


Fig. 7. Rigid wick oiling type of two-piece bearing, used as a pillow block.

faces, the rate of relative motion, and the pressure exerted by the moving element upon the stationary or bearing surface. The actual reason for the occurrence of solid friction is regarded as the presence of a relatively infinitesimal number of more or less minute elevations and depressions. According to the care observed in the machining of the surfaces the intensity of these irregularities can be somewhat controlled. On the other hand, they can never be eliminated, as examination of the most polished surfaces will show under the microscope. As a result, when one such surface is moved over another, the two being held in relatively uniform contact by means of externally applied pressure, the elevations of the one will tend to engage with the depressions in the other, molecular attraction tending to hold them together. In order to bring about sliding motion between these two surfaces, energy must, therefore, be expended.

The introduction of a film of oil between these surfaces, however, will compensate for the depressions and elevations, and therefore, keep the surfaces out of actual contact. Solid molecular attraction will thus be reduced to a great extent, and solid sliding friction replaced by the fluid friction of the lubricant, or, in other words the friction which exists between the particles or layers of this latter. So we can consider lubrication as the elimination of sliding or rolling friction by the formation and maintenance of a lubricating film be-

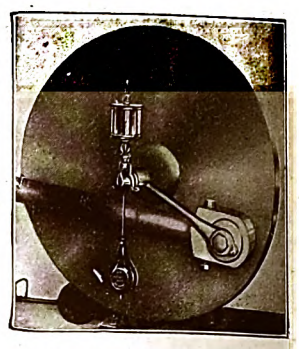


Fig. 8. Crank-pin center oiler equipped with oil cup, for the positive lubrication of crank-pin bearings.

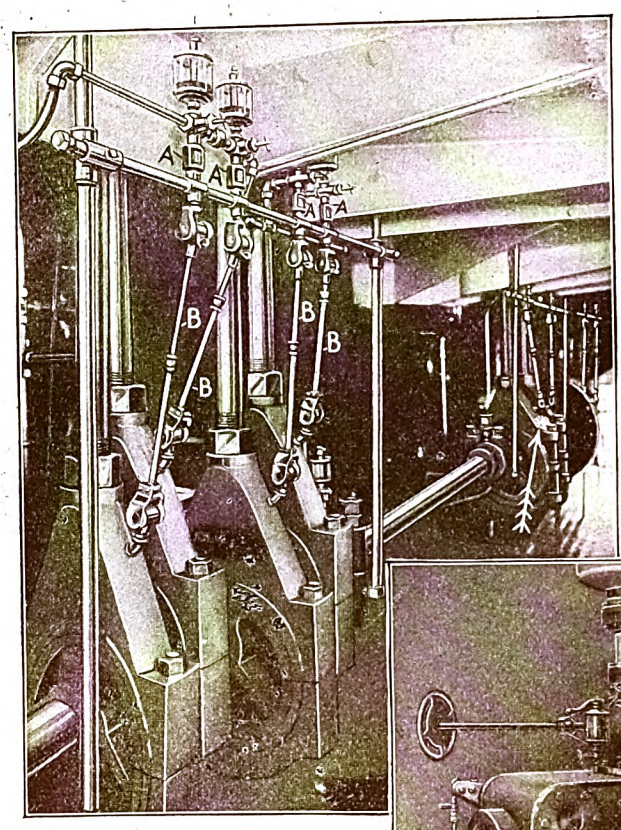
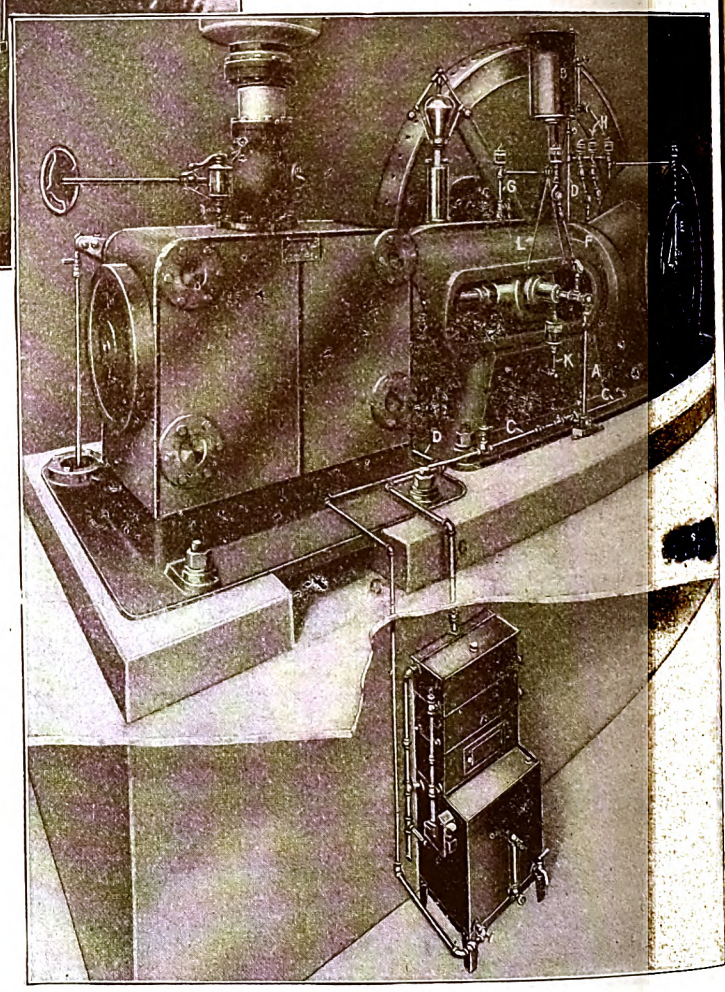


Fig. 9. Illustration of the method of lubricating eccentric bearings of a pumping engine by means of telescopic eccentric oilers.



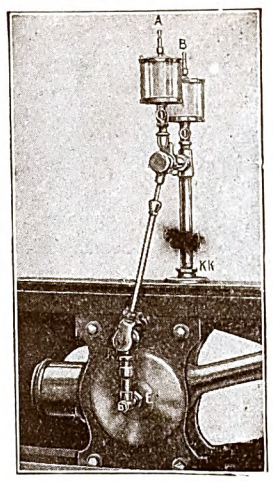


Fig. 10. Engine crosshead pins and guides demand positive and dependable lubrication if bearings are to function properly. The telescopic positive feed oiler shown above serves this purpose well.

Fig. 11. Lubricants for bearing service must be properly filtered, etc., and often circulated continuously to all bearings. Therefore an automatic return gravity feed system as shown above, for engine service is of decided value.

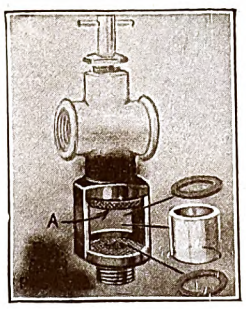


Fig. 12. Details of a removable glass, sight feed bearing oil cup, with glass removed for cleaning.

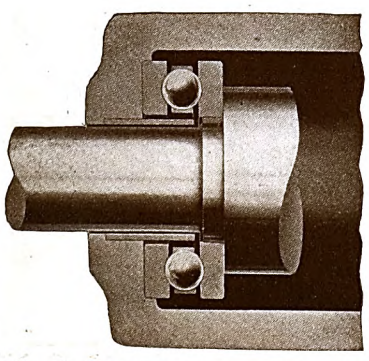


Fig. 13. Showing the method of application of ball bearings to a thrust bearing.

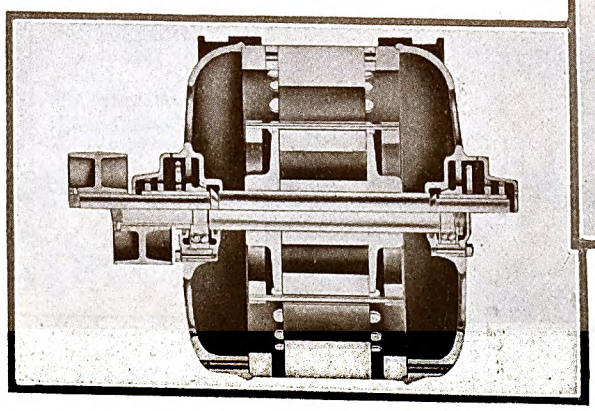


Fig. 14. Sectional view of a motor equipped with ball bearings. Lower half of shaft indicates length with ball bearings, the upper half the length with ring-oiled or plain bearings.

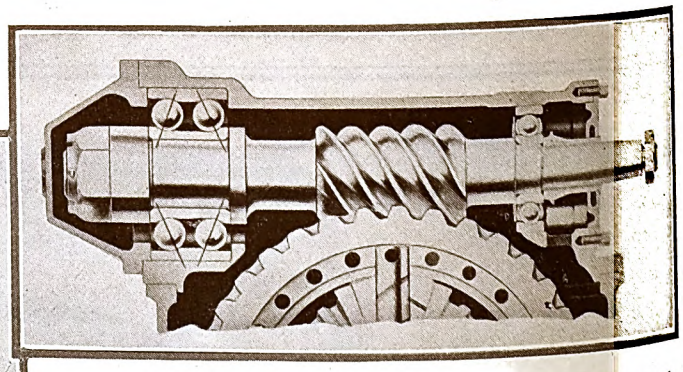


Fig. 15. A motor truck worm drive showing a double row radial thrust ball bearing which serves to carry combined thrust and radial loads.

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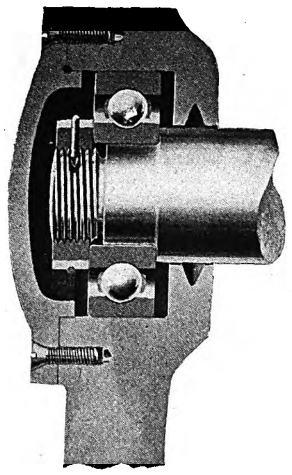


Fig. 16. A radial type single row ball bearing installation.

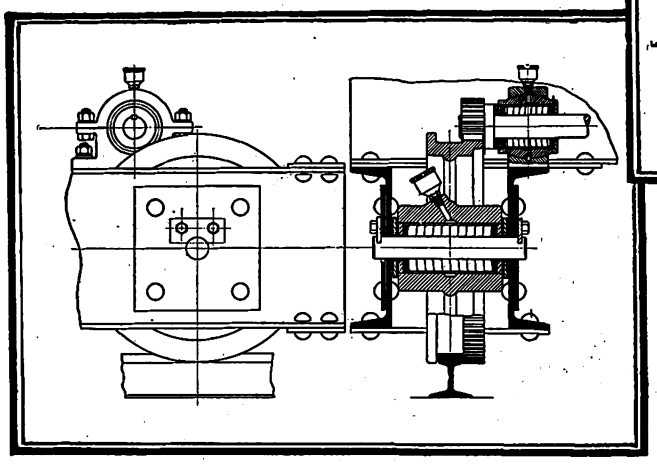


Fig. 17. Showing method of application of roller bearings to the bridge wheel of a traveling crane.

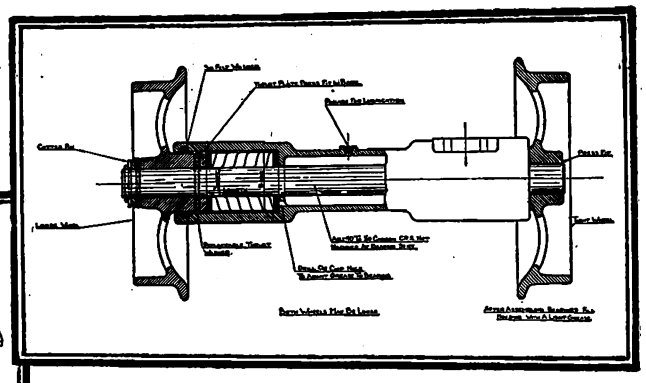


Fig. 18. Roller bearing mounting for mine car bearings.

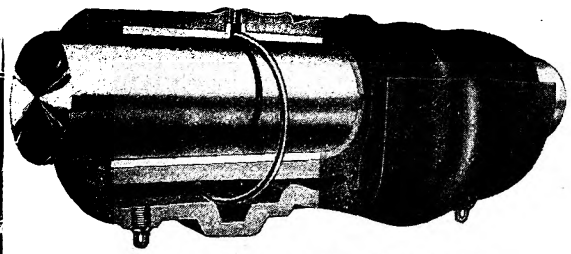


Fig. 19. Details of a ring-oiled bearing showing relation of ring to journal.

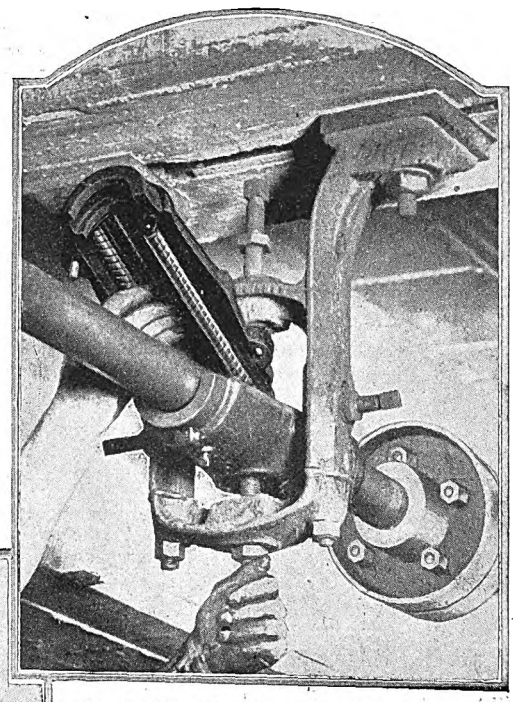


Fig. 20. Showing the method of removing half of a roller bearing from a line shaft support.

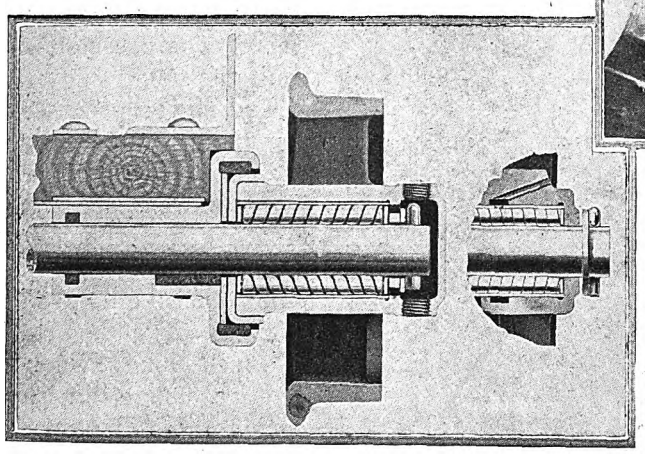


Fig. 21. Sectional view of a roller bearing showing details of design.

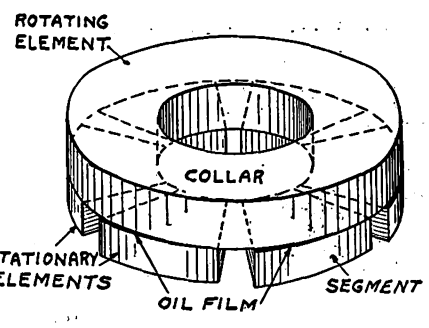


Fig. 22. Details of a well-known make of thrust bearing.

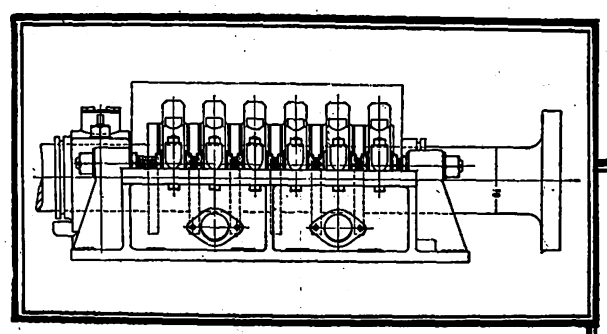


Fig. 23. Side elevation of a horse-shoe type thrust bearing.

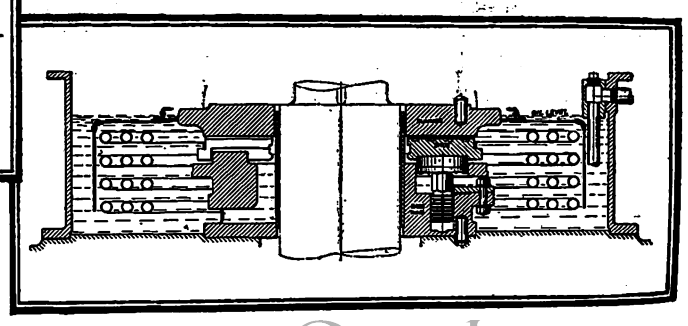


Fig. 24. Water cooled type of vertical thrust bearing.

tween any two bearing or rubbing surfaces which are in motion with respect to each other.

Where layers or particles of a fluid in motion in a bearing encounter irregularities in the metallic surfaces, the former are lifted over any projections by virtue of the pressure exerted by adjacent particles of the fluid which constantly endeavor to occupy the entire clearance space. In other words, fluid friction is independent of bearing pressures, hence the component coefficient of friction due to pressure is eliminated.

The extent and thickness of the lubricating film is usually a variable, which will be governed by (1) The rubbing speed; (2) The viscosity of the lubricant; (3) The load which is to be carried by the moving element or shaft; (4) The shape and degree of smoothness of the bearing surfaces; (5) The area of the bearing surface and (6) The provisions that are made for distribution of the lubricant, such as the oil grooves, or the chamfering or beveling of the edges of the bearing metal.

Having reviewed bearing surfaces, it is now well to discuss the various types of bearings we may encounter in the average industrial plant today. In general, a bearing is known as any surface or point of contact which is capable of serving as a support or guide for another surface which is subject to motion with respect to the first. Therefore,

(*Continued on page 72*)

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Electric Welding and

The Practical Achievements of a

By J. F.

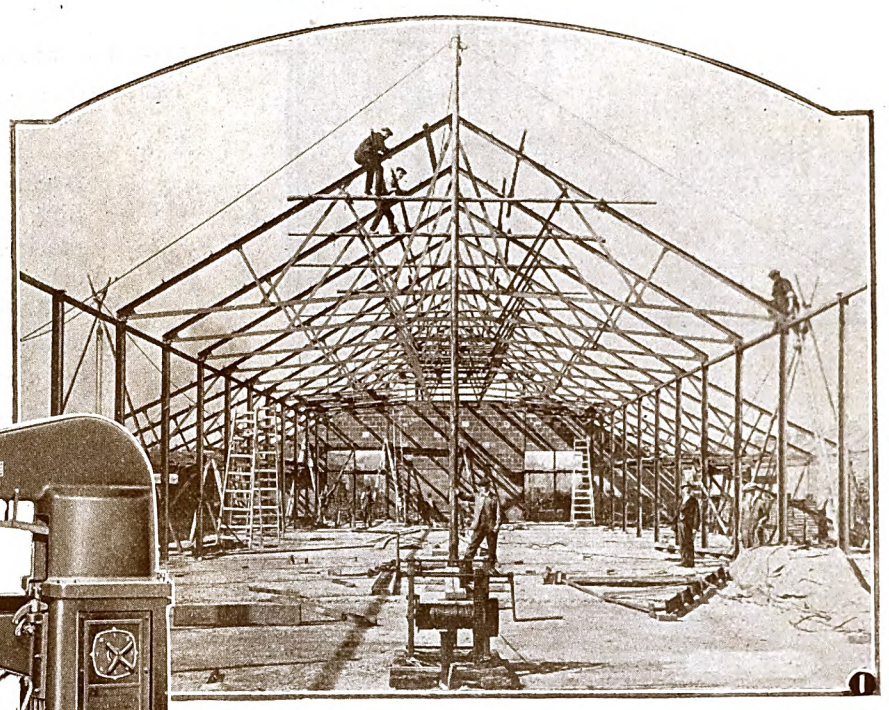


Fig. 1. In steel construction work, standard shapes may be cut and welded electrically at the point of erection, as in this English factory building.

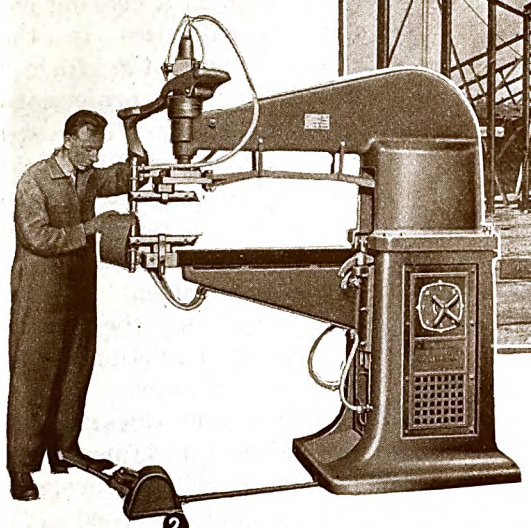
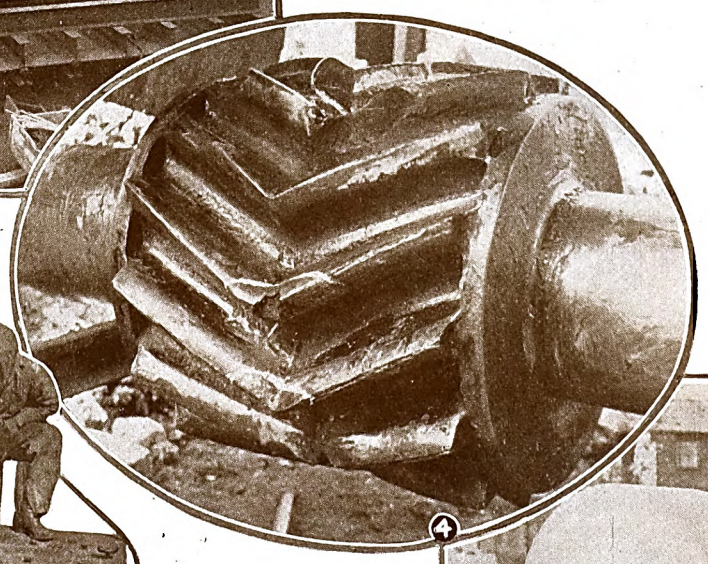


Fig. 2. Below—A type of spot-welding machine which is adaptable to rather large work.



Fig. 3. At the left—This man is working on a large annealing cart, which is electrically welded throughout.

Fig. 4. Below—Showing how arc-welding can be used to repair broken teeth in a large steel pinion used in a steel mill roll drive.



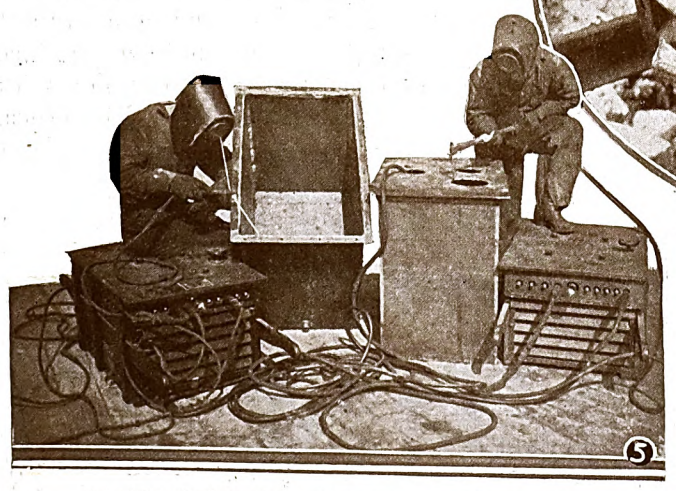


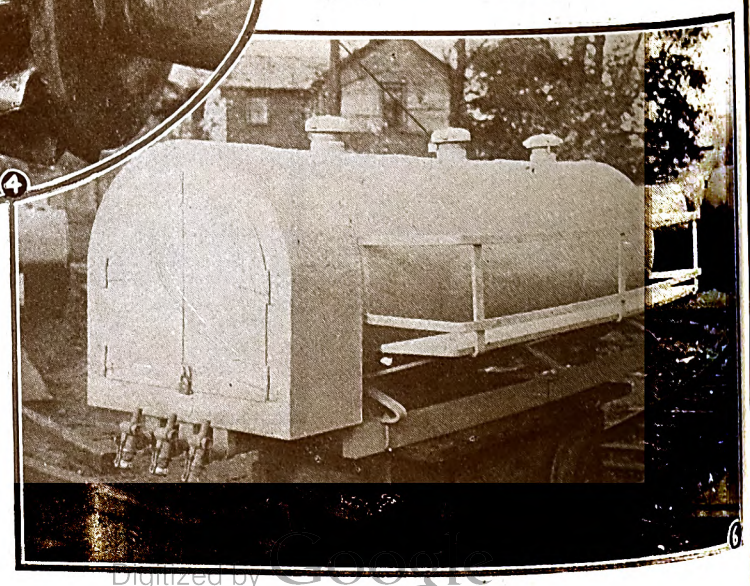
Fig. 5. Portable outfits for arc-welding and cutting.

THE old-time method of welding employed by the blacksmith has probably never been surpassed. The smith, by the use of borax or otherwise, cleans the surfaces and unites the metal by hammer blows resisted by the anvil. One great advantage consists in the fact that while the temperature required is high, it does not need to approach the melting point. A plastic condition is sufficient. The compression induced between anvil and hammer does the rest.

But there are serious limitations. First, the class of metals to which the system is applicable is very limited—iron, steel, nickel, and perhaps one or two other metals of a more or less unusual character. Even in the cases where the metal itself is to be rated as weldable, certain limitations may have to be imposed. Thus, iron is weldable and so is steel, but cast iron is not. Second, the difficulties inherent in making provisions for the necessary heat and the necessary compression operate to limit the field.

The newer processes of welding have wonderfully enlarged the opportunities of application. These newer processes are principally gas methods on one hand and electric on the other. The chief gases employed, in addition to oxygen, are hydrogen and acetylene. Such processes require usually a fusion of a considerable amount of metal in

Fig. 6. This big gasoline tank, for truck mounting, was welded throughout electrically.



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lts Applications

Young, but Growing Art

SPRINGER

ne immediate region of the eld. There is, in this circum- ance, an important feature istinguishing gas welding from nvil welding. However, the se of metal at the melting tem- erature carries with it a valu- ole advantage. Compression is ot required. The molten mate- al flows together. However, here is undoubtedly disadvan- ge in the excessively high tem- erature.

Now, electric welding includes ithin itself two principal pro- esses which resemble, one of em, the older process used by e blacksmith, and the other f them the fusion method char- cterizing the gas procedures. hat is to say, *arc welding* con- itutes one of the two chief ethods of using electricity. n arc is created and this arc is sed to fuse metal and thus ring about the weld. Then, here is *resistance welding*. It the second principal process y which electricity is employed. he surfaces to be welded to- ether are brought into a more r less close contact. In the re- ion of contact, however, the assage of an electric current is npeded by the existence of a reak where conduction is im- erfect. This region of imper- ct conduction supplies *resist- nce* when a current is passed cross it. The result is heat. If ow we add compression to the eat, we have the elements nec- ssary to anvil welding.

The use of the electric arc as

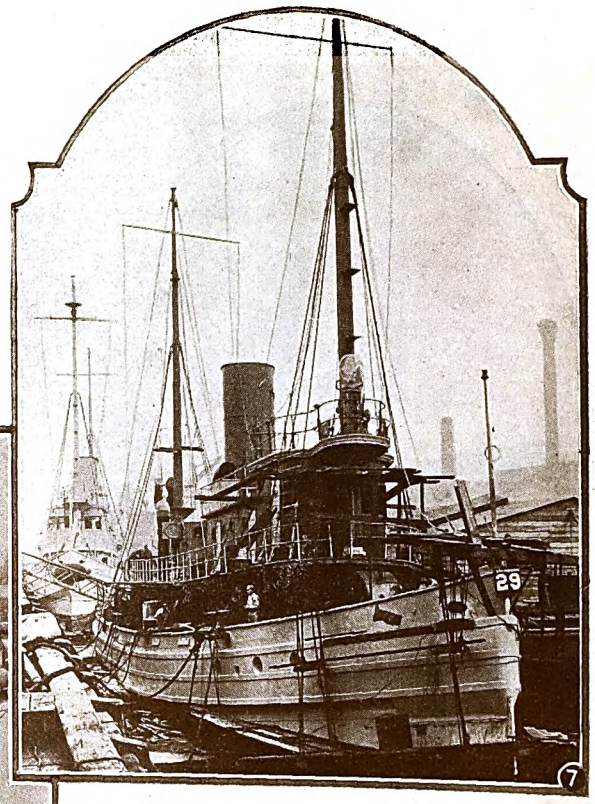


Fig. 7. At the right—Steel masts, such as are used on this Government boat, lend themselves to electric welding.

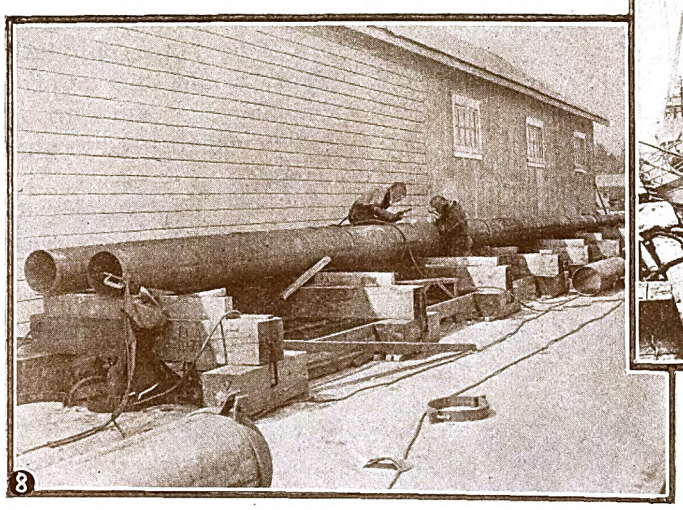


Fig. 8. Here is shown the operation of welding seams and joints on masts for Government boats.

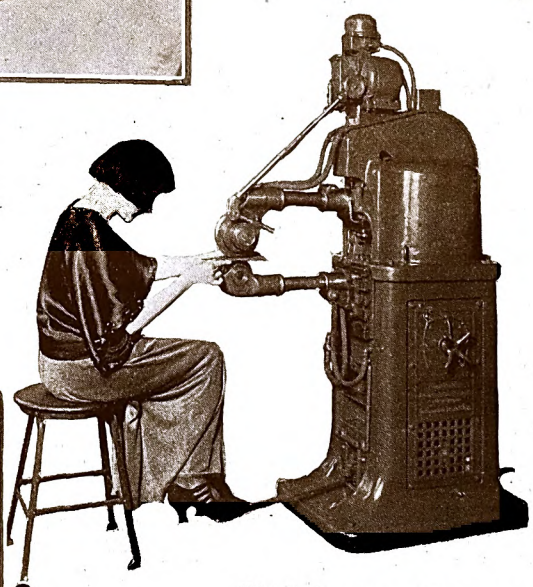


Fig. 9. A seam welding machine, for small work.

Fig. 10. At the left—An arc-welded cast iron cylinder of 80″ bore, 60″ stroke, cracked 5 feet on near side and 3 feet on far side, whose repair saved over eleven thousand dollars and more than seven months' time.

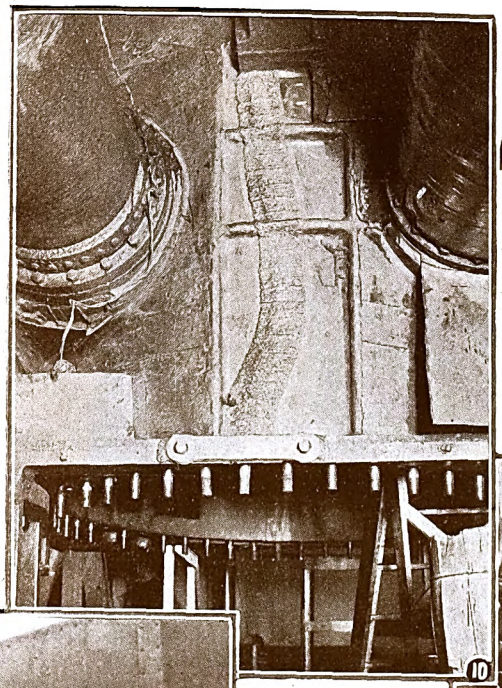
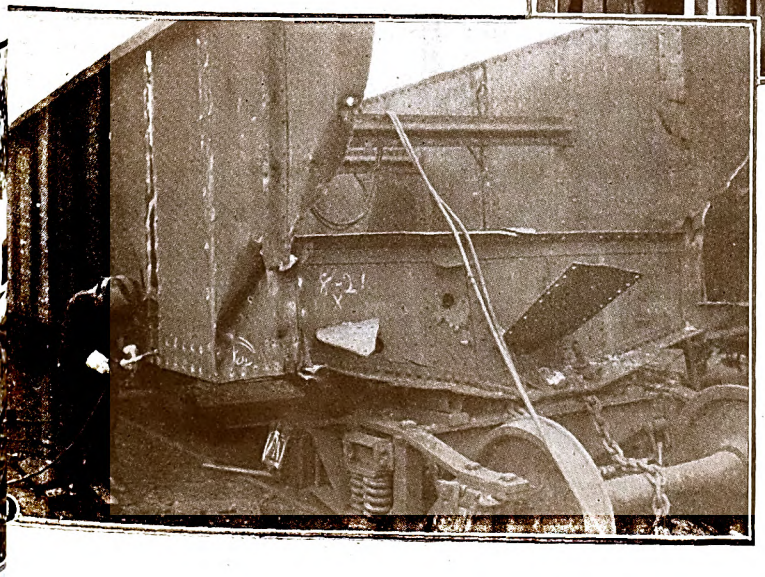


Fig. 11. Below—Using the electric arc for cutting rivets and steel plate, in scrapping old freight cars.



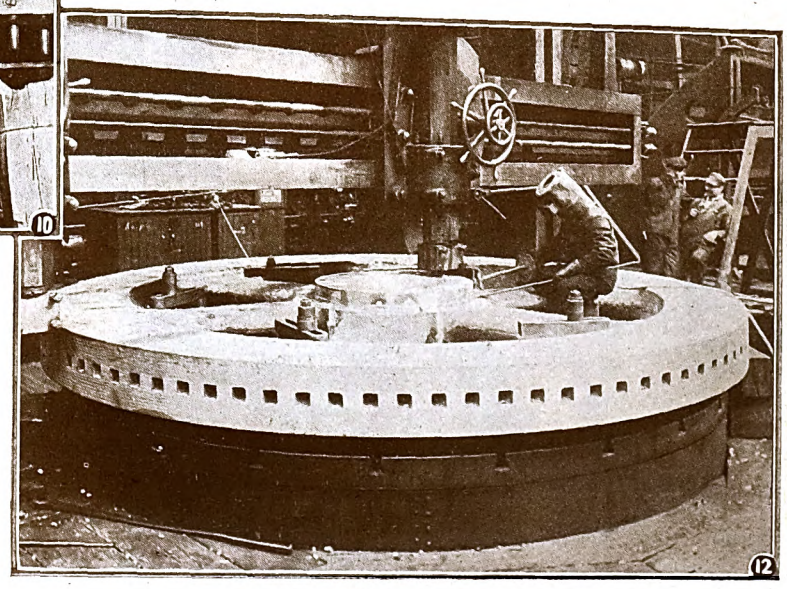


Fig. 12. Arc-welding a defect discovered when machining a large fly-wheel hub.

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Fig. 13. Fabricating structural iron parts with an arc-welding machine.

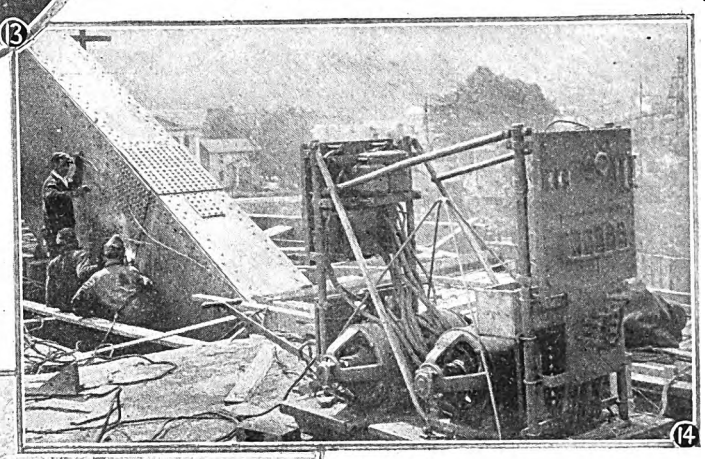


Fig. 14. At the right—Anchoring rods to bridge plates, on an Oregon bridge, by electric welding.

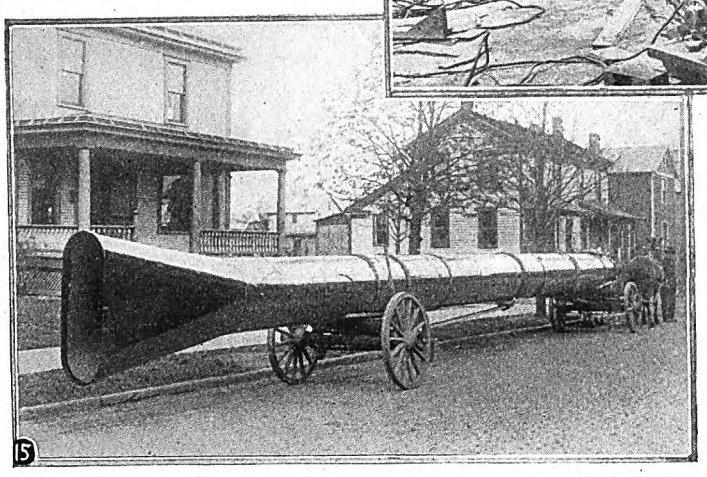


Fig. 15. A fifty-foot stack, electrically welded throughout.

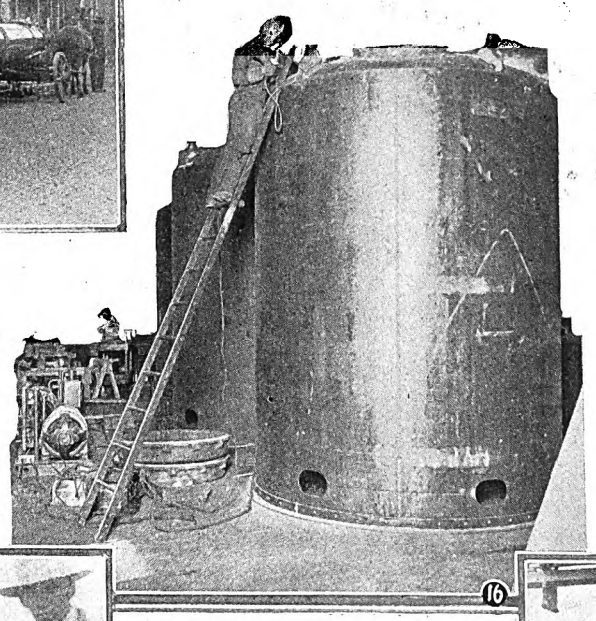


Fig. 16. Welding the tank of a big 220,000-volt oil circuit breaker.



Fig. 17. Arc-welding misplaced rivet holes in structural work.

a means of uniting metals is said to be older than the resistance method. There is reason for believing that it was used as far back as 1881 in welding together parts of electric storage batteries. What was done appears to have been substantially this: The work was connected up with the positive pole of a source of current. The negative pole was connected to a carbon rod. Upon touching the rod to the work, and then withdrawing it a little an arc could be formed. There would thus be produced a considerable amount of heat which was utilized in uniting the parts.

There are several methods of employing the electric arc. One of these, which does not appear to have much practical importance, creates an arc by using two carbon rods, mechanically held to form a V. The arc may be directed to the points desired by means of a powerful electromagnet. A modification of this method has been devised which makes use of carbons containing a small relative amount of metallic oxide. In consequence, the arc may be increased in size and the work saved to some extent from excessive carbonization. It is understood, however, that not even in this modified form is the two-carbon process of a very practicable character.

There is another procedure which may conveniently be termed the one-carbon system. The carbon and the work are each connected to a pole of a source of current. It is sometimes considered preferable to connect up the carbon to the negative pole, as this provides against a stream of carbon particles flowing onto the work and thus carbonizing it.

Still another system of arc welding is known as the metallic-electrode process. Here the work constitutes one electrode, but the other is a metal rod and not a carbon one.

There is also a process which may perhaps be classed with the preceding. A metal rod constitutes one electrode, but the rod is covered or sheathed in a special way. Particular attention is directed to the fact that the process using a metal rod covered with a special sheath may be employed either with direct or alternating current. Certain electric arc welding processes require direct current, but this particular system is not thus limited to the one class of current.

Perhaps another electric process ought to be mentioned. It

(*Continued on page 51*)

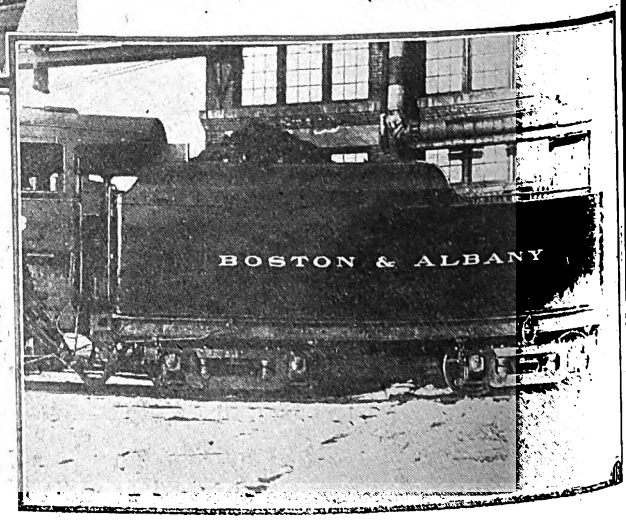
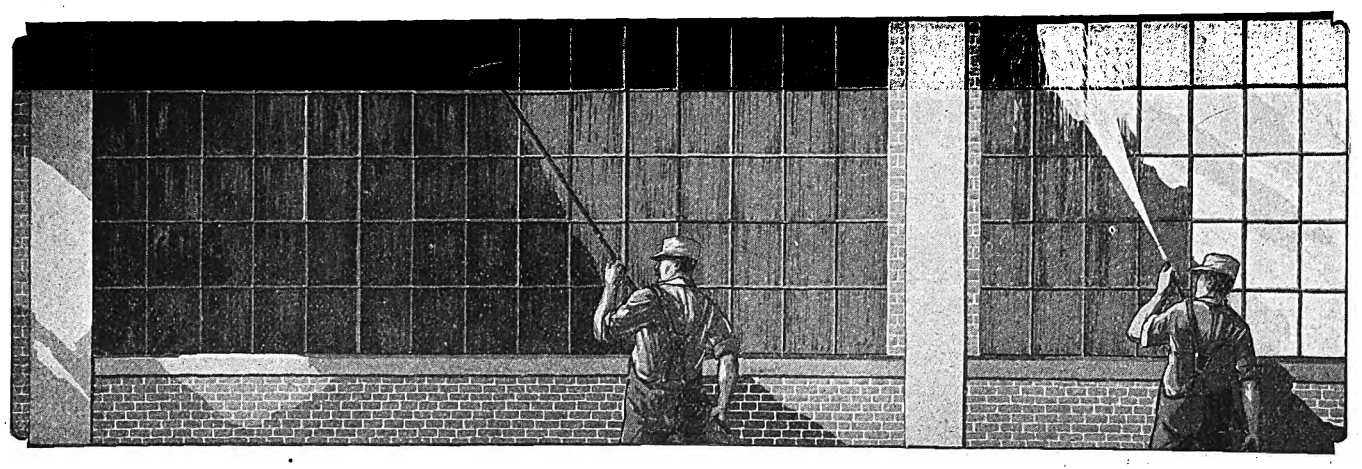


Fig. 18. A locomotive tender without rivets—electrically welded.

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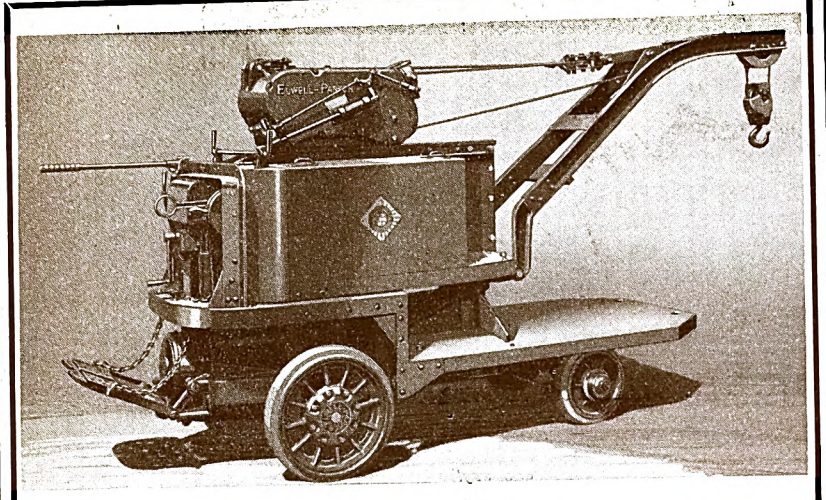
Skybryte in bbls. $2.50 per gallon freight allowed

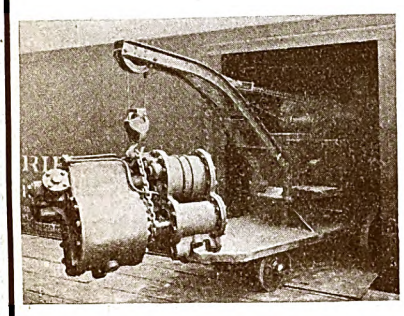
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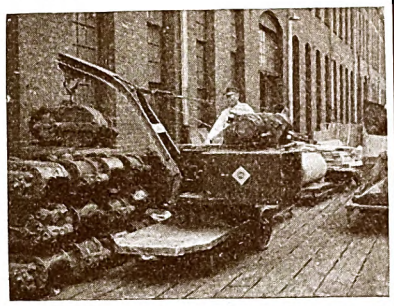
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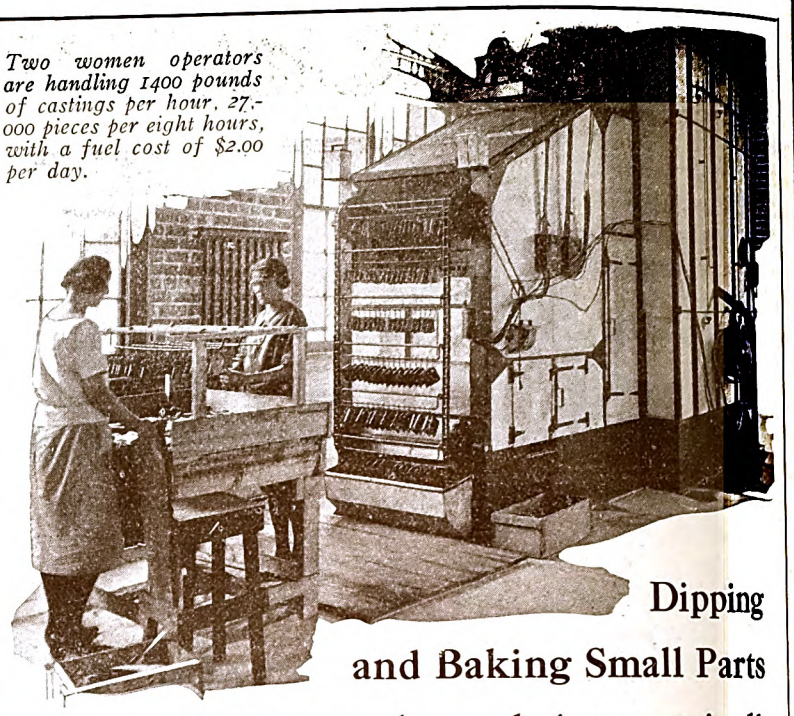
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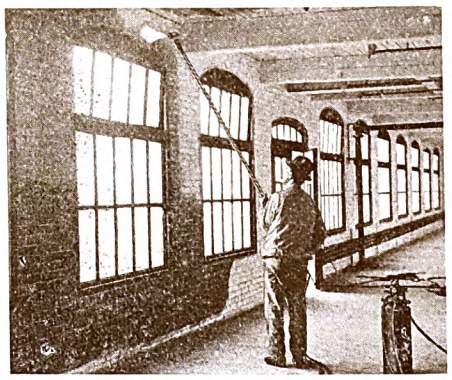
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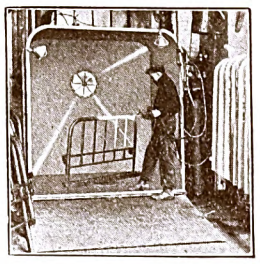
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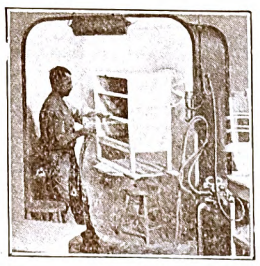
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Carpentry, Masonry, and Plant Maintenance

(*Continued from page* 12)

ler should be examined often as hey are a source of danger if hey should break while a man s near the top. Wooden lockers re now nearly obsolete, the steel nd expanded metal lockers hav- ng so many advantages that here is not much to be said gainst them. Steel lockers re- uire little maintenance. With ough usage the doors may need traightening up so that they vill close easily, and locks are requently put out of order and eed repairing. Where there is ot enough room for single lock- rs the double tier lockers may e used. The men don't like hese in the winter because they re not long enough to hold their eavy overcoats, so it is often etter to put two men together n one large locker than to use he double tiered ones.

The doors between adjoining uildings or doors in fire-proof artitions between different ooms in a large building are ery important from the stand- oint of fire protection. They hould be regularly inspected to ee that they close properly and nat the chains and fusible links re in good working order. ravity sliding doors are often locked open by employees to eep them from shutting, but his practice should not be al- wed because the door would ot shut in case of fire. With eights properly adjusted to alance the door it should move asily. Swinging fire doors are sed at exits to stairways and hese should always be kept in orking condition so that they ill close tight in case of fire, ecause the regular fireproof air tower is apt to become filled ith smoke. Both these types f doors are usually tin covered n heavy lumber doors, and to tain the underwriters' ap- roval the tin covering must be reserved intact. Fire-proof evator doors are of various pes, possibly the most used nd being the vertical raising nd lowering counter-balanced pe. The lower half of this or forms a sill for trucks be- g pushed on and off the ele- tor. For very large doorways e rolling steel door is admir- ly adapted because of its abil- y to roll up into a small cas- g when not in use. These are nd or motor operated accord- g to their size and unless they e bent or otherwise distorted ey should require very little maintenance outside of painting. The newer types of combination folding and sliding doors are also used on large openings and the horizontal folding doors are also largely used. Doors leading to bridges or to outdoors are often in the path of continual trucking and some provision should be made for opening and closing these doors without the necessity of having the trucker stop to open and shut them. Double doors hung on double swinging spring hinges may be opened by pushing the truck into them and allowing them to close after it has passed. However, with electric trucks the doors must be heavy and be protected on both sides with thin sheet steel to stand this abuse. Doors in wooden partitions such as office partitions should be equipped with door checks so that they will close silently and

(*Continued on page* 33)



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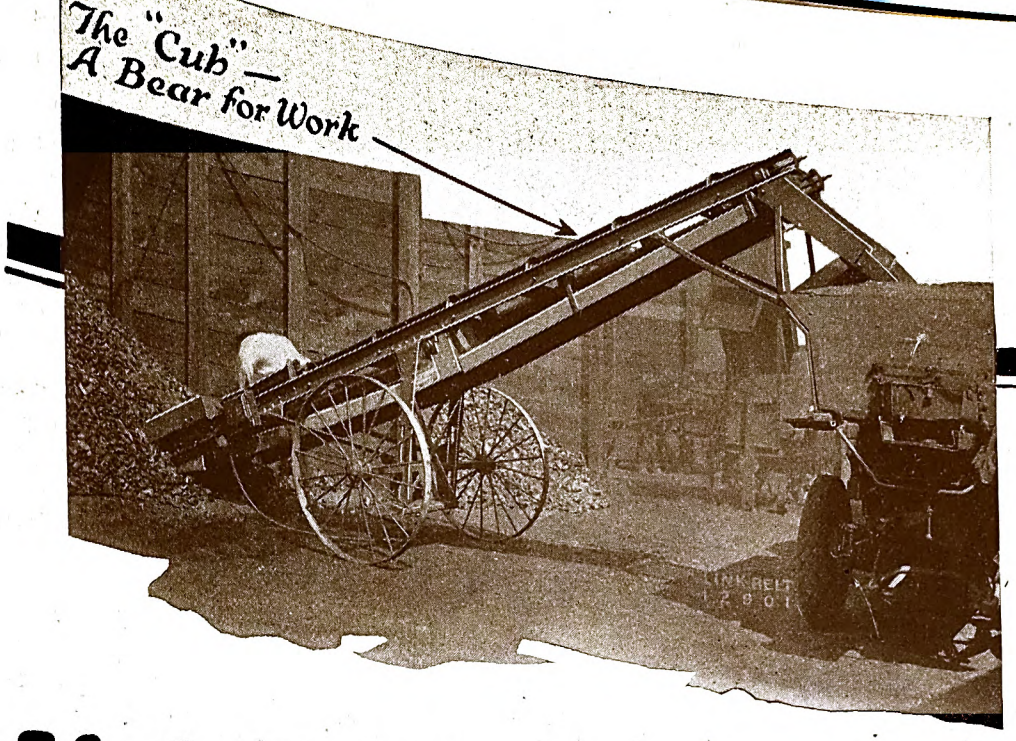
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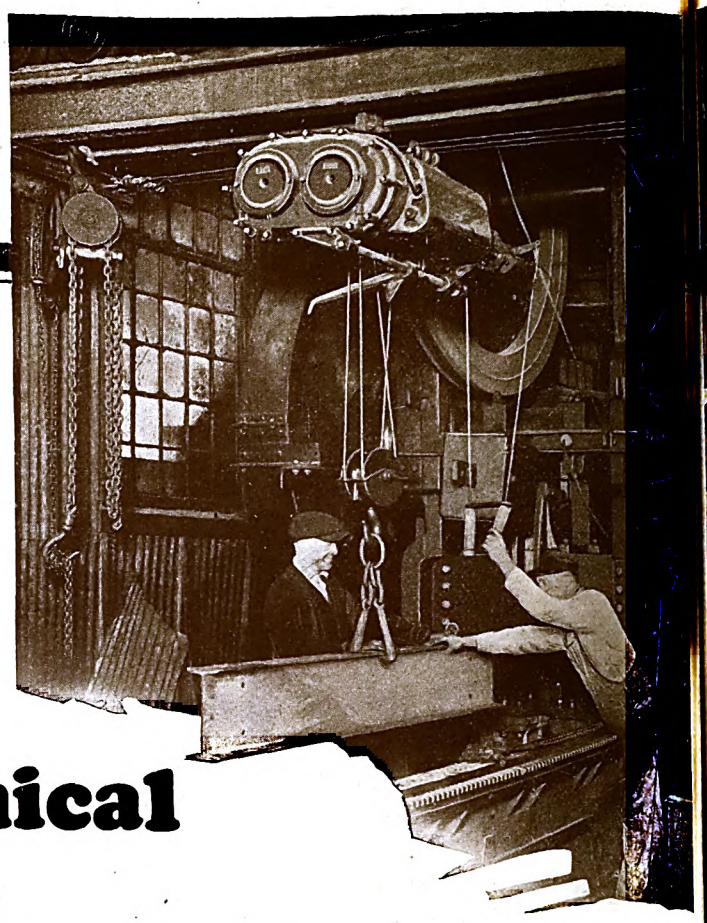
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Hundreds in daily use throughout the country, testify to its merit. It is the most popular unit built by Link-Belt. The "Cub" can load material faster than half a dozen or more men. It knows no superior in design, construction or performance. It is a Link-Belt Guaranteed Product.

Ready to work when you get it—fully equipped. While we can furnish any type of motor to suit local conditions, our standard "Cub" Loader, selling at the new low price (without the special chute shown in the illustration), is equipped with—

2-H. P. two or three phase, 60 cycle motor, 21 ft. conveyor length, 18″ wide belt assuring large capacity. Belt is guaranteed against cutting or fraying. Wide loading hopper at foot of conveyor is hinged—easily and quickly opened. So simple and sturdy anybody can run it. Loads 45 cubic feet of material per minute.

Price, $485 f. o. b. Philadelphia or Chicago. If you now load materials by hand, you are losing time and money.



Use This Coupon

LINK-BELT COMPANY
2045 Hunting Park Ave.
PHILADELPHIA, PA.

Please send me your book on
☐ Electric Hoists
☐ Portable Loaders

Name _____

Address _____

City _____ State _____

The Link-Belt Electric Hoist—

Use your ceiling—instead of your overcrowded floor—to carry your materials from place to place—with the highly efficient Link-Belt Electric Hoist. Move a 50-lb., 1000-lb., or 2500-lb. load by the mere pull of a control. Lift, carry, deposit, at the will of the operator. So simple anyone can run it. Does the work of many men—and is popular with workers, because it makes hard lifting a simple, easy and pleasant task.

"Let George Do It"

Shopmen call the Link-Belt Electric Hoist by the fitting, descriptive name—George—because it does all the work that famous phrase implies.

If you lift and carry iron, steel, or machine parts or finished products—indoors or out—or handle your material to and from machines, or from one department to another—write for our catalog No. 480, and see how easily and economically it can be done with the Link-Belt Electric Hoist.

The Link-Belt Electric Hoist is made in many sizes. The illustration shows our standard 3-ton hoist, and illustrates but one of many varied applications.

Price, $300 f. o. b. Chicago or Philadelphia, for the 1000-lb. standard Link-Belt (C½) Electric Hoist, a neat, compact, efficient machine that will show savings even in the small-size plants.

Send For These Books

They may point the way to overcoming bothersome handling problems. Write and tell us how you handle your materials, and let Link-Belt experienced engineers study your methods. They may suggest better methods of handling that will speed up your production. We make no charge for advice, layouts or estimates. Asking for Link-Belt catalogs entails no obligations.

LINK-BELT

Elevating and Conveying Machiner

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"We should have built the shelving over there! It's too bad we didn't buy convertible steel shelving in the first place—then we could have moved it as needed."

Don't Wish You Had Built The Shelving Elsewhere

Use Van Dorn Convertible Steel Shelving and Relocate it Whenever Required.

NO man living can look far enough into the future to know what shelving is going to be permanently required. Your needs grow! And change! And shift from place to place!

Modern practice is to install Van Dorn Convertible Steel Shelving, built up from standard units wherever required. Whole banks can be moved. Sections taken out or added. All torn down and reassembled. Built around doors and windows or under stairs. Any type of shelves, closets, etc. Closed or open. For light or heavy burdens. Plain or with attractive trim.

Inexperienced office help can do it, and the only tools required are a screwdriver and wrench. Don't use built-in shelving. Send for catalog of Van Dorn Convertible Steel Shelving.

THE VAN DORN IRON WORKS COMPANY

Mastercraftsmanship-in-Steel

CLEVELAND

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Van Dorn

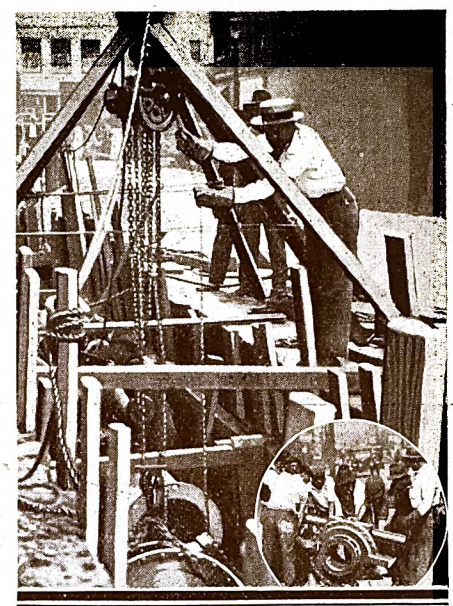
MASTER-CRAFTSMANSHIP IN STEEL

(*Continued from page* 31)

not disturb anyone. Door checks should be adjusted to the size and weight of the door they are to close.

Shop partitions should be adapted to the service they have to give. For average shop service, where a cheap and fairly strong partition is desired, the wooden partition made of a two-by-four-inch framework with beaded sheathing to a height of forty-two inches and expanded metal or wire netting above, makes a good, serviceable partition. It is usually run to a height of seven or eight feet. When glazed sash is used above the beaded sheathing this partition may be used for shop offices. Both of these types of wooden partition have the disadvantage of having to be built in place for the particular job and if they have to be moved the breakage caused by ripping is very large. Steel partitions of all kinds have the very great advantage that they can be set up and taken down as often as necessary without loss. For shop partitions, solid steel to a height of about forty-two inches with expanded metal above, is the usual choice, although some prefer all expanded metal on a steel frame. Expanded metal resists blows from trucks or other objects extremely well and for this reason is largely used in preference to wire netting. For shop offices steel partitions with solid panels below and glazed panels above make an excellent combination. In large rooms where only a little heat is required a small office partitioned off in this way may be heated to the temperature desired without the expense of heating any other part of the room or building. There is on the market a wooden partition with glass upper portion and with top section telescoping so that it can be moved and adjusted to various ceiling heights. This is built in panels similar to steel partitions and is principally used for office partitions where there is a probability of moving them to accommodate changes.

Steel sash are subjected to rough usage due to the men slamming them shut. The hardware and catches on the swinging sash should be in good working order so that the catch will snap and hold the sash tight without slamming it two or three times. This is also apt to warp the sash and they will not be weather tight in storms. The



CYCLONE HOISTS
HIGH SPEED

We saw this Exampel of Labor Saving From Our Office Window!

IT took nine husky men, with many a "yo" and a heave, to place this ponderous fitting in position for lowering into a trench dug by the Cleveland Electric Illuminating Co. for laying the steam pipes to the new Union Trust Building, Cleveland.

When hooked to the Cyclone Hoists, rigged over the trench, one man alone lowered the same heavy weight into position!

One never need go far to find places where a Cyclone Hoist can save labor and cut costs. Perhaps *you* need only look out *your* window into your factory yard, your shop or warehouse to see instances where a Cyclone Hoist can profitably replace muscle-methods. Look!

Send for catalog covering 1 to 40 Ton Hoists Cranes, Trolleys and Overhead Track Systems

DISTRIBUTORS EVERYWHERE

The Chisholm-Moore Mfg. Co.

Cleveland, O.

Hoists Cranes Trolleys

Overhead Track Systems

Branches: New York Chicago Pittsburgh.

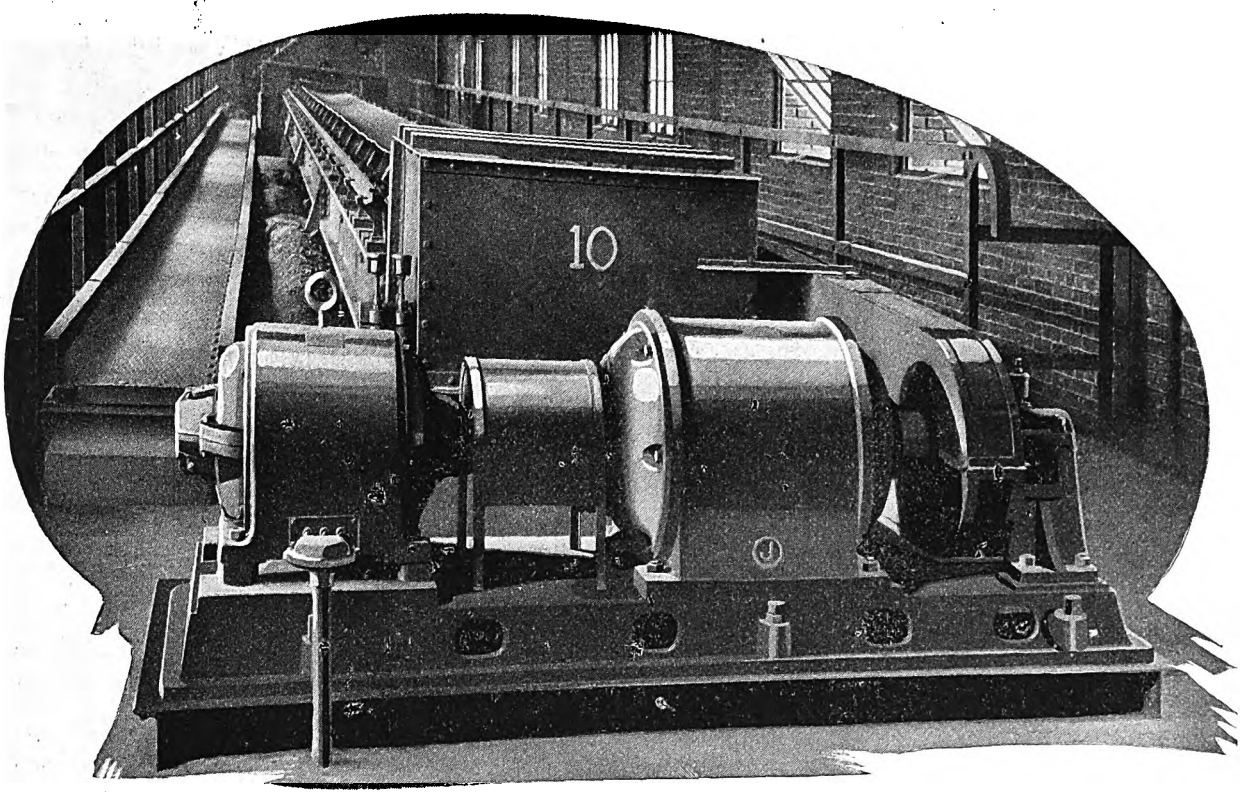
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work left on and spoiled during a storm during the night will amount to more than the expense of taking care of this detail. Slamming the lower sash will loosen the sash in the concrete sill and this joint should be kept tight with a plastic cement like roof cement. The outside of the sills should slope enough to keep water or snow slush from leaking in. The savings in coal by taking care of these items will more than repay the cost. Ventilation is necessary but it should be under control. Air leaks around windows on a cold windy day often make it impossible to heat the side of the building facing the wind. In office buildings or other buildings with wooden sash a metal weather strip should be used all around. This effectually takes care of air leakage and keeps windows from rattling. For upper steel sash the chains for holding the swinging portions open should be arranged so that any degree of opening desired may be had. Some chains fit into slots in a bracket on the lower sash, or rings may be fastened to the chain, so that any opening may be had by hooking the ring on an inverted hook. Monitor sash or other high sash are best controlled by sash operating devices having a rod or shaft controlling a row of sash. The method of rotating this shaft from the floor may be by chains or shafts connected by bevel gears.

The front board on benches will need to be replaced quite often where rough work is done on the benches and this can easily be done if the benches are built with pressed steel or cast iron legs to which the board is bolted. The bolt heads should be countersunk into the board and a wooden plug driven in above the bolt head after it is tightened up so that the top surface will be smooth and will not scratch any work. An economical way of building benches is to use a heavy maple or other hardwood plank on the front of the bench only and fill in the back of the bench with seven-eighths inch tongued and grooved flooring laid in short lengths at right angles to the front board. Usually the heavy work is done on the front of the bench and a heavy plank on the back half of the bench is an unnecessary expense.

Industrial track should be kept lined up to make for economical hauling, and switches and crossovers should be kept in good condition so that cars will not get off the track. The running gear on the cars will often be damaged or the frame bent and this should be taken care of by the machine repair department. Car bodies and decks should be repaired or replaced when worn or broken so that no work will fall off or become damaged. The rail and switches on overhead monorail systems should be kept in working order, the switches are especially important.

On swinging sash, shades on rollers are hard to handle unless each sash has its shade fastened to it and arrangements are made for fastening the shade at the bottom of the sash to keep the wind from whipping the shade when the sash is swung open. To overcome this trouble with shades sometimes a curtain is made of white canvas or heavy muslin and hung on rings on a pipe above the window. This pipe should be bent out from the wall so that the curtains will hang almost straight when the



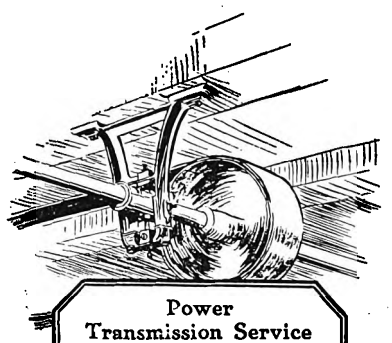
Reduces Electric Motor Speed in a Simple, Efficient, Economical Way

Here is shown a Jones Speed Reducer—identified by the circle J trade mark—driving a Coke Breeze Conveyor in a Water Gas Plant. The electric motor speed is 860 R.P.M. The final speed is 24.1 R.P.M.—a reduction ratio of 35.64 to 1.

This compact, complete reduction unit eliminates belts, shafts, pulleys or exposed gears. Gives greater power efficiency. Prevents accidents. Cuts depreciation and upkeep expense. Saves space.

After installation, the Jones Speed Reducer needs no attention other than occasional oiling. An enclosed unit, running in an oil bath, it operates perfectly under all atmospheric conditions.

We have just published a book on the subject of power transmission and speed reduction. It will interest you, for it contains much valuable information and is well illustrated with photographs of actual installations. A request will bring you a copy by return mail.



Power Transmission Service

IN addition to spur and worm gear speed reducers, we manufacture a complete line of power transmission appliances—hangers, pulleys, couplings, pillow blocks, friction clutches, ball-bearing loose pulleys, safety collars, etc.

The service of our engineers is at your command. Their experience may prove very helpful. We will be glad to have you write us.

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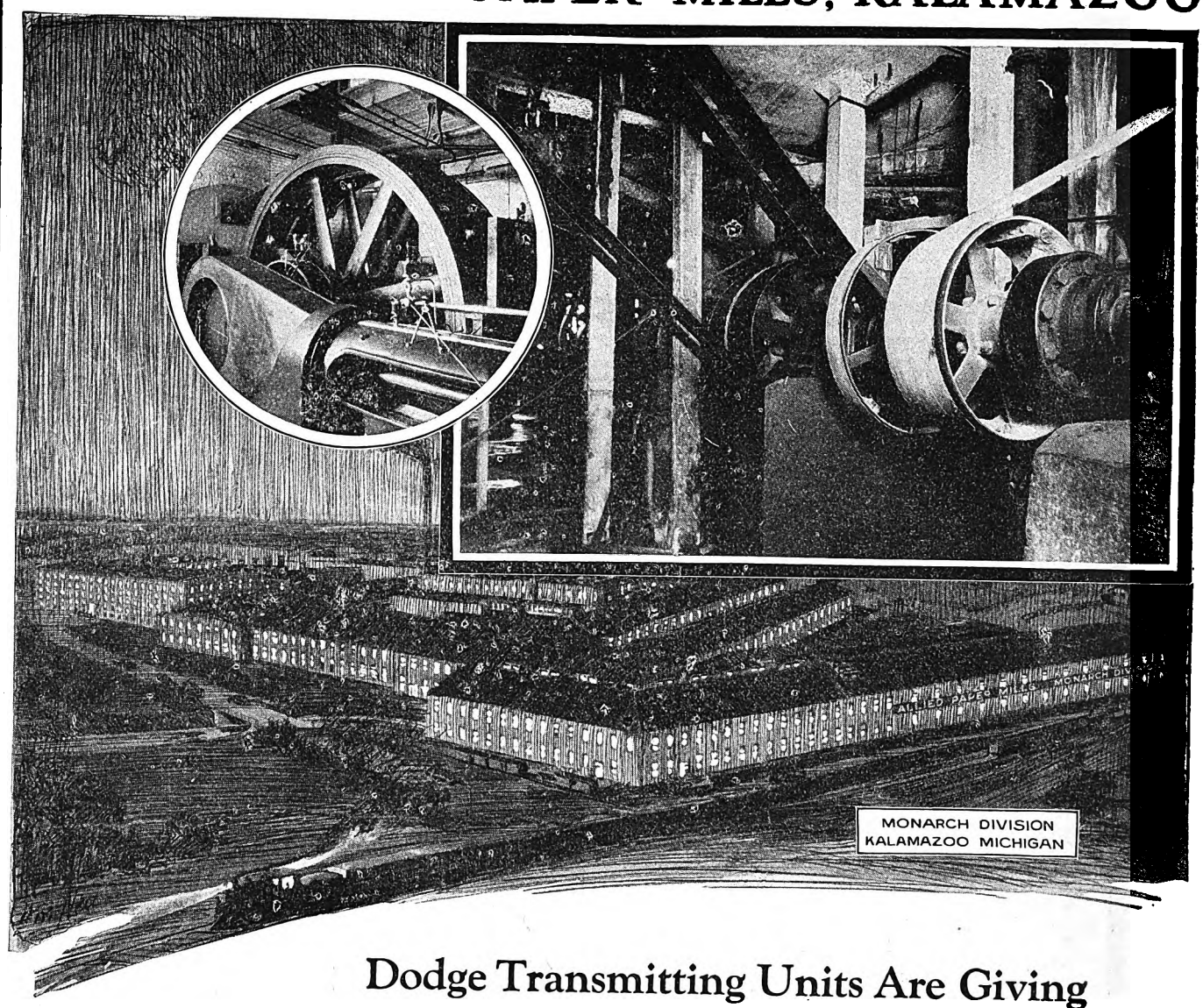
swing sash are open. With twenty-foot windows a one-inch pipe supported in the middle is usually used. When not in use these curtains may be tied back at both sides of the window. Shades made of thin wooden slats that allow air to blow through but keep off the direct glare of the sun are used in many plants. These are used mostly in rooms exposed to full sunlight. Awnings may be used on small windows in office buildings and are often used on large windows of modern plants but the wind whips them and often breaks the fittings, making their use dangerous, due to danger of breaking the windows. Their use is usually limited to offices.

Picket and board fences require a great deal of care even if they are kept well painted. Posts of cedar last a long time but the upper part of the fence will usually outlive two or three untreated posts. Posts may be treated with creosote or some other preservative or they may be coated with hot tar on the part that is underground. One of the main points to be taken care of on fences is to build them so that water will not lodge anywhere. Posts should be beveled at the top and the end grain well painted. Wire fences supported on pipe or structural shape posts are coming into their own on account of their permanence and fine appearance. The posts are either driven into the ground and thoroughly braced or are set in concrete. This type of fence requires very little maintenance except painting. It is very hard to climb and as barbed wire may be stretched on inclined arms at the top it makes an excellent protection for a plant. Iron fences are also excellent fences but usually cost more than wire and are used for places where appearance is a factor. If kept well painted they will last for many years.

The cost of shipping the manufactured product can often be materially reduced by making a careful study of the conditions. When large quantities of the same piece are shipped day after day the weight of the container is important in order to keep down express and freight charges. The selection of the correct wood for the job is also important, as many light weight woods have as much or more strength than the heavier ones. On crates, the importance of proper bracing and the use of the three way corner are having their effect in the lessening of breakage in shipment. It is sometimes surprising how much the amount of lumber may be reduced in a crate and still be as strong as before. Box and crate making can be best done in a medium sized plant in the carpenter shop along with the other work, but in large shops it should be an individual unit. A very economical way to build boxes is to buy the box shooks in bundles and assemble the boxes in the shop. Where large quantities of boxes are required a complete box making department equipped with machines for cutting, grooving and glueing the boards is usual. Nailing machines are also necessary. It has been found that a box nailed together with cement coated nails will usually stand one and a half times as much handling as a box with ordinary nails. The carpenter shop should build the trays for machined parts. These trays should be made to fit the piece after the first cut is taken on it and be so made that the work

(*Continued on page* 37)

IN THE ALLIED PAPER MILLS, KALAMAZOO



Dodge Transmitting Units Are Giving 24-Hour Service

Alex G. Gilman, Pres. Allied Paper Mills, says:

"Dependable power transmitting machinery is as necessary to the manufacture of paper as is dependable paper to the production of fine printed works. Power costs always have been an item for the careful consideration of the mill executives, and in this period of high material and labor costs and the necessity for maximum production, we must watch every leak, be it power or material. We develop around 9,000 horse power, operate 24 hours six days a week, and trouble in our engine rooms or on our power line would stand us heavy losses."

In the Monarch Division of the Allied Paper Mills at Kalamazoo, Michigan, Dodge pulleys, hangers, bearings and clutches, and rope drive have been rendering 24 hour service, six days a week for 14 years.

Throughout the extensive operating departments of the Allied Mills, Dodge equipment is giving the type of continuous service the business of paper making demands. Dodge means power savings. Plants standardizing on Dodge rank on the plus side of the ledger in power actually delivered to production.

Five hundred local dealers distribute Dodge products on the immediate delivery basis. Trained engineers are always available for expert counsel on the special machinery demands of industry.

DODGE MANUFACTURING CORPORATION

General Offices: Mishawaka, Ind. *Factories:* Mishawaka, Ind., and Oneida, N. Y.

DODGE

EVERYTHING FOR THE MECHANICAL TRANSMISSION OF Power

Branches: New York, Philadelphia, Pittsburgh, Boston, Cincinnati, Newark, Chicago, Atlanta, Minneapolis, St. Louis, Houston, Seattle, San Francisco

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Do You Lose Money *Between* Machining Operations?

EVEN if your plant is equipped with the most modern production machinery, there is still a big chance for you to lose money ***between*** machining operations!....Why? Simply because you may not be ***moving*** your material with dispatch, or economy (i. e. low labor cost).

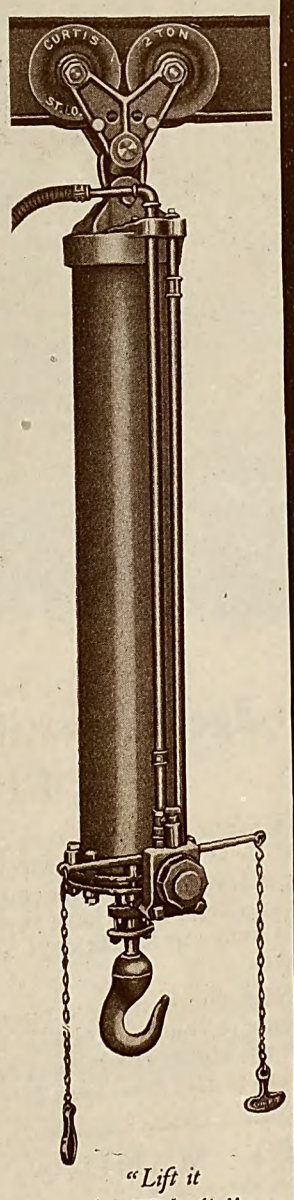
Curtis All-steel ***Air*** Hoists and Roller-bearing Trolleys lift and move any kind of material, quickly, economically and safely, making use of a power already available in most plants. They save time and energy and men—before, during, and after machining operations. With Curtis I-Beam Trolleys a 4000-lb. load can be moved by a 50-lb. pull.

Capacities up to 20000 lbs. and various types to meet your particular needs. Send for full information.

CURTIS PNEUMATIC MACHINERY CO.
1668 Kienlen Ave. St. Louis, Mo.

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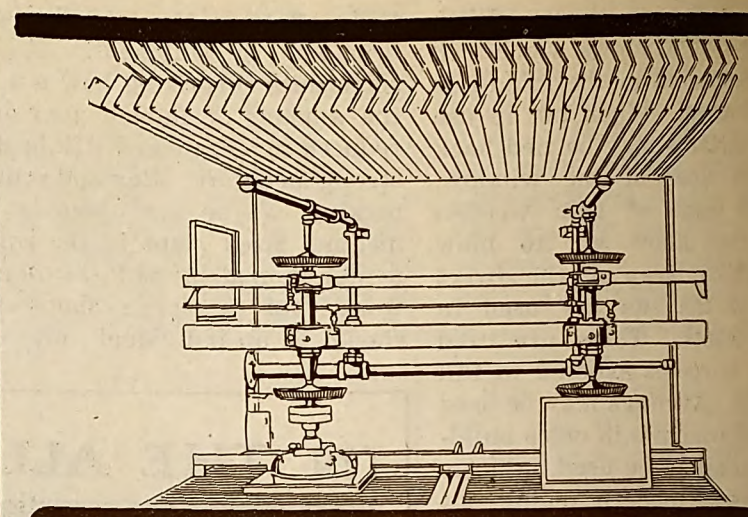
536-S Hudson Terminal, New York City



"Lift it With Air"

CURTIS ST. LOUIS
AIR COMPRESSORS—HOISTS—TROLLEYS—CRANES

CURTIS



A Non-Clogging Air Washer with Tandem Atomizer.

The illustration above shows top view of the atomizer chamber of a

Bayley Turbo Air Washer

The four motor operated sprayer discs create a very dense double spray of infinitesimal particles of water through which air must pass before it enters the room. In this passage through the screen solids, dust, soot and other impurities are removed from the air, leaving it pure and sweet as after shower breezes.

As a conditioning unit it will keep temperature and humidity uniform throughout the year, regardless of weather conditions. Unique construction of the atomizers keep the water spray uniform in density and clogging is entirely eliminated.

Especially designed for churches, schools, theatres, food producing establishments, hotels, public and office buildings.

Write for Booklet

Bayley Mfg. Company, (Dept. P) Milwaukee, Wisconsin



Let Us Do Your STAMPING

Use Your Own Labor and Equipment on More Important Work

INCREASE production, lower costs and do a much larger volume by such an arrangement.

Fifteen acres of modern mechanical equipment and 1200 workmen, trained for this special work, enables us to produce Stampings and Pressed Metal Parts at minimum cost.

Our estimate will prove that we can furnish any design, any metal, cheaper than you can produce them in your own plant.

42 years of experience is a guarantee of highest grade workmanship and On-Time deliveries.

G.P.&F. SERVICE
"KNOWING HOW SINCE '81"

Send Samples or Blue Prints

for estimate on any quantity of Stampings or Pressed Metal Parts in Aluminum, Steel, Brass, Copper, Tinplate or Sheet Zinc. We also submit estimates on Gas and Electric Welding, Tinning, Galvanizing, Japanning and Porcelain enameling.

Consider These Advantages

Many manufacturers who used castings, forgings and wooden parts have changed to Stampings and Pressed Metal Parts because the latter are cheaper, lighter, less cumbersome and stronger.

They are delivered ready for assembling without time and labor spent for machining and fitting.

Geuder, Paeschke & Frey Co.

1457-1750 Canal Street
Milwaukee, Wis.

352-358 W. Ohio Street
Chicago, Ill.

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(*Continued from page* 35)

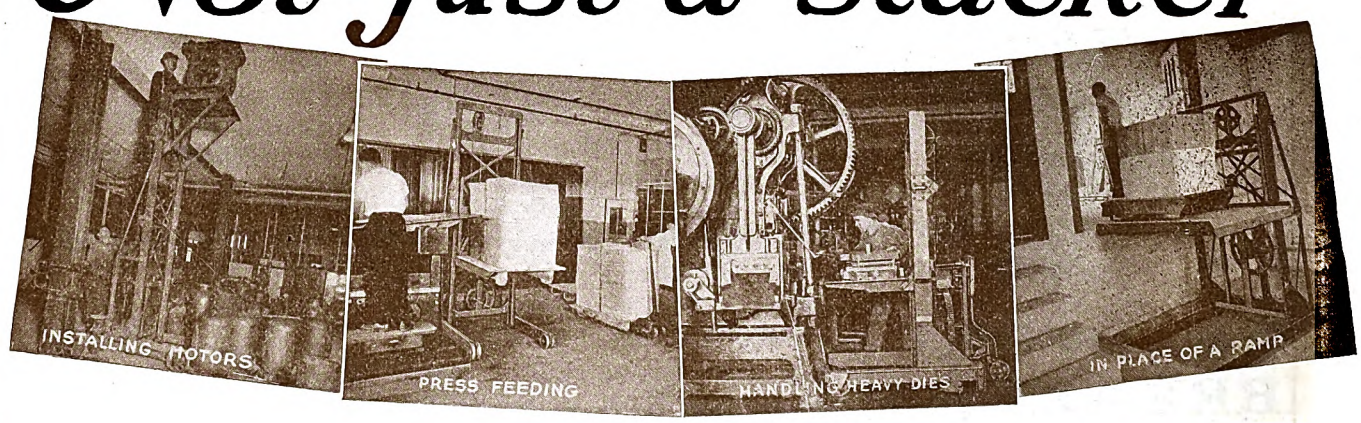
nnot slide around and have rners bent over while the tray being moved from one maine to the other for the next eration. The work may be sily inspected with trays and e number of pieces can be sily counted. In plants where me of the product is shipped oak or mahogany boxes a cabet making group of men is necsary on account of the finer ork. These boxes are usually cely finished and fitted with ckeled trimmings.

Truck platforms for lifting ucks must be sturdily made to st under severe service. The cks should be of heavy plank d the boltheads should be untersunk so the deck will be nooth. Wooden side supports not stand up well so metal gs and angle iron supports are ing used more and more. To iffen this construction the bolts lding the legs should go rough the angle iron. Special aped bodies or racks on trucks platforms are necessary to ndle odd shaped pieces ecomically. Iron or steel wheels heavy trucks soon wear ruts the floors and these ruts alw trucks to drop suddenly on e side often throwing material the floor. Rubber or cushion red wheels and casters on ucks save wear on floors, and e therefore a good investment. n electric trucks these tires are necessity to lessen the shocks the truck when it hits unevenss in runways or floors. The ietness of tires is also a disnct advantage when trucks ve to travel through asseming rooms. Trucks or cars ith racks on them for use in panning ovens are usually of l steel construction to stand e heat, and they must be freiently oiled in their bearings as soon dries up.

The mason work in a plant is ten handled by the carpenter reman especially if he is one the all around builder type. his work is largely confined to pairs and replacements on ors and walks, together with teriors and exteriors of walls. he corners of the walls at ther side of doorways through hich trucks pass are apt to beme broken off by trucks hitng them, and it is well to proct them with a steel angle iron t into the wall from the floor to a height of about four feet. n patching up holes in concrete ors or walks a wash of neat ment should be used so the new concrete will stick to the old. Walks and truckways and ramps or inclines in the plant should have easy grades for economical trucking. All railroads have what they call a ruling grade, which is the steepest grade allowed on the system. Likewise a plant should adopt a ruling grade so that a truck can be loaded to capacity and get to its destination with the load. If lift trucks are used there should not be any abrupt changes in grade as they may cause the load to drop if the change is very abrupt. Walks between buildings should be well drained so that frost will not heave them. Few of us realize the tremendous force of frost until we have seen the results of it. Composition floors are often laid over old worn floors and troweled smooth, making a rather inexpensive method of renewing floors. The masons' work includes pointing up exterior brickwork and in this work special attention should be given to cornices, parapet walls and chimneys as these are places most likely to require repair.



Not just a "stacker"



The Economy Portable Elevator is Ready for *Any* Job of Lifting

DON'T think of Economy Portable Elevators as just "stackers." They will not be limited by this nick-name to the one job of piling.

It is true, they are stackers, and good ones, too. But the hundreds of different kinds of lifting jobs that are being done by these machines earn them the right to be thought of and called by a more descriptive word. They are lifters, not stackers.

Look at the pictures above. There isn't a stacking job in the lot, but every machine is doing its special lifting work in a highly efficient and satisfactory manner and at less cost than possible with any other type of equipment. The buyers of these installations thought of these machines as what they are: lifters, and profited by the thought.

Therefore, we say again, let's get away from the idea that Economy Portable Elevators are merely stackers; let's think of them as lifters and see how their legitimate field of usefulness broadens at once.

Economy Engineering Company

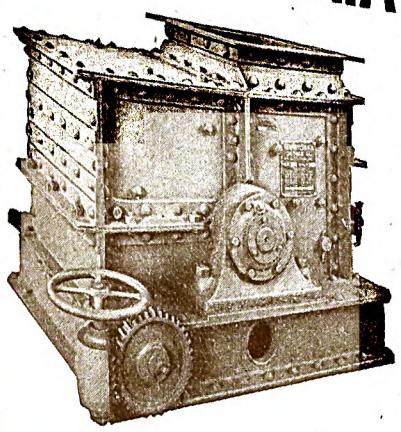
2663 West Van Buren Street, Chicago, Ill.

We have a representative near you.

New York Office: 342 Madison Ave.

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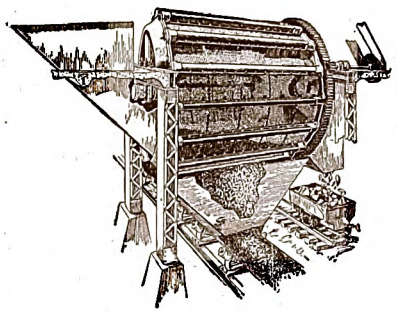


HAMMER CRUSHERS

39 Sizes

For Coal, Lime, Limestone, Shale, etc.

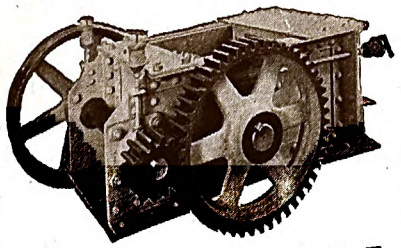
(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
(c) Oversize Bearings
(d) Patented Tramp Iron Separator
(e) Manganese Steel Wear Parts



BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY

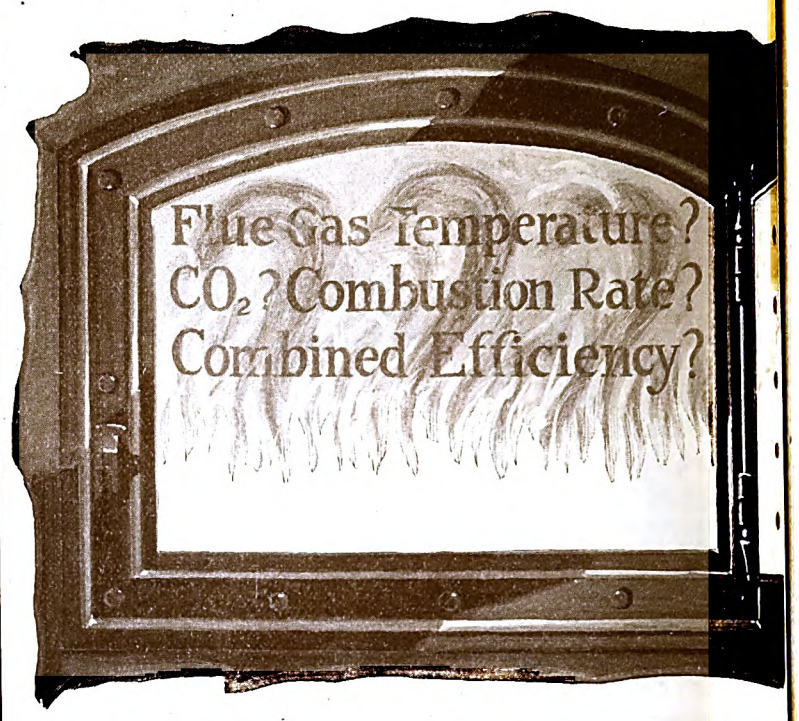
Stephen Girard Bldg., Philadelphia.
New York Pittsburgh Chicago

Machine foundations under large and heavy machines have an important influence on their operation. Reinforced concrete often allows the use of a smaller volume of concrete than if plain concrete was used. To get sufficient area without much depth a grillage of steel beams is often used. For special jobs like drop hammers a concrete sub footing with heavy hardwood timbers on end is usually used. As these timbers do not last many years at their best, only high grade lumber should be used and the timbers carefully bolted together. In plant work the average plastering is given a troweled sand finish as this compares in smoothness with rubbed down concrete and when painted two coats is smooth. In toilet rooms the lower sections of the walls are often of glazed tile with hard white plaster above. Floors are usually of tile of either small or large blocks. Repairs on tile are rather hard to make as it is necessary to carefully chip out the worn sections and fit in the new. Slate and marble have been largely used as partitions in toilet rooms but in factories the use of metal partitions is gradually becoming universal.

An efficient machine repair department is a necessary part of the maintenance work in any plant. A method of doing regular repairs at stated intervals to keep the machines in good condition at all times is insurance against breakdowns at critical times. With this system each machine is carefully recorded on a card giving the cost, rate of depreciation and present value, and having spaces for labor and material expended on repairs since its purchase. When a repair is made the cost is entered and an estimate is made of the probable future date when repairs should be necessary. This date is carried in a tickler file and when it comes around the machine repair department foreman should inspect the machine to see if repairs are necessary. If so a work order should be entered.

On large machines it is necessary to bring whatever tools are necessary to the machine and repair it on the job but on small machines that require a thorough overhauling it is best to send them to the machine repair shop. The machining of any special parts will have to be done in the shop and it is best to have the machine handy for

(*Continued on page 40*)



Your furnace as an expert sees it

TO a combustion engineer the fire in your furnace is not simply a blinding blaze but a series of chemical reactions and controllable factors. He knows through chemical analysis exactly how much heat and steam each pound of your coal should produce. To him, sweating firemen and a general bedlam in the boiler room are not acceptable evidence that the maximum of heat is being given up by the coal.

On the contrary, the combustion engineer's test is an accurate calculation that takes into consideration temperature of feed water, coal analysis, steam pressure, quantities of water, coal, and the many other elements which enable him to establish furnace and boiler efficiency with scientific certainty.

Mechanical stokers have been developed by combustion engineers and are installed in your plant by combustion engineers on a basis of insuring better results. When you install mechanical stokers you get not only highly developed stoking machinery, but the best of engineering counsel as well.

It is this combination of service and equipment that makes fuel saving, labor reduction, and smokeless operation a foregone conclusion before the installation of mechanical stokers is even begun.

The part that engineering has played in mechanical stoker development is told in the free book, "Coal—The Basic Fuel." A card to the secretary of the association brings a copy to you—free.



This Book FREE



BURN COAL

"The *basic* fuel"

STOKER MANUFACTURERS' ASSOCIATION

G. A. Sacchi, Secretary, Lester Branch, Philadelphia

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This Ad is only for owners of Photo Copying Machines

If you have an interest in the *QUALITY* of your work—and uniform results

Make this Test

Send us an order for a roll of Rectigraph photo record paper, spooled to fit your apparatus. Have your operator test it out for speed, contrast, color values and strength of basic raw stock—and then place your future orders as dictated by your experience.

Have the satisfaction of buying your photo record paper and chemicals direct from the pioneer manufacturers.

The merits of Rectigraph Photo Record Paper and the fairness of price are proved by the regular repeat orders from hundreds of satisfied customers.

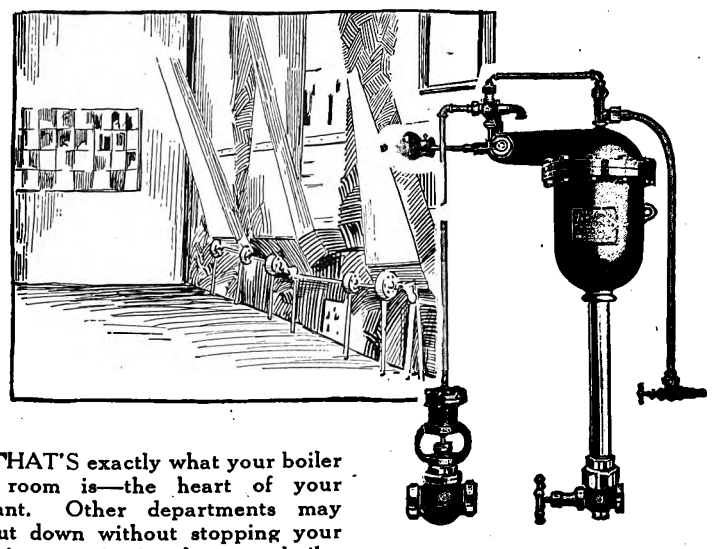
Rectigraph Company

(An Independent Corporation)

Originators of the Photo-Copy Machine

278-284 HOLLENBECK STREET, ROCHESTER, N. Y.

Protect the Heart of Your Plant



THAT'S exactly what your boiler room is—the heart of your plant. Other departments may shut down without stopping your entire organization, but your boiler room must go on steadily if any wheel is to turn. Like the human heart, its proper functioning is of vital concern to every other part of the plant.

Vigilant Feed Water Regulators do their share—and more—toward maintaining the flow of production. They prevent boiler explosions; they automatically fix water levels; they conserve your costly fuel; they guarantee maximum operating efficiency. After 25 years of service, they are recognized as the best.

Our engineers will be glad to go over your boiler room and make money-saving suggestions—without obligation to you. Write us to-day.

The Chaplin Fulton Mfg. Co.

28-36 Penn Avenue, Pittsburgh, Pa.

THE TEC UPLIFT



For Lower Labor Costs

—Investigate this Improvement in Industrial Transportation

The more interested you are in lowering your handling costs the greater will be your interest in the **TEC UPLIFT.**

Here is an elevating truck that has unloaded five cars of miscellaneous freight in 3¼ hours, distributing the materials an average of 300 feet. It will unload and load your freight cars and motor trucks, stock goods in your warehouses, and do faster, and at much lower cost the miscellaneous handling jobs, which now require so much costly hand labor.

And like all **TEC TRUCKS** no concrete roadways are needed. Any road is suitable for a **TEC.** That alone in a **TEC** means a great amount of money saved.

TECS ride over Belgian blocks, cinder filled paths, through snow, ice and sleet — up a 20% grade the load—in fact the toughest roads mean nothing to **TEC TRUCKS**

The **TEC UPLIFT** will raise the load from 5 inches above the floor to 8 feet 6 inches and there are no small pilot wheels to interfere in traverse and close stacking.

We'll be glad to go over your own conditions and give you specific information.

TERMINAL ENGINEERING CO., INC.

15 West 44th Street,

New York

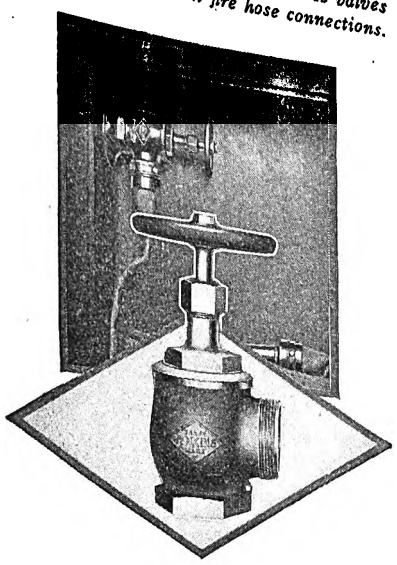
District Engineers in Various Cities

TEC TRUCKS

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Jenkins Bros.

Jenkins Bronze Fire Line Valve installed in wall case in American Telephone and Telegraph Building, New York City. These valves are used throughout on fire hose connections.



Fire!

Fire!

In the very important and responsible work of providing adequate fire prevention service, Jenkins Valves play a part in the new building of the American Telephone and Telegraph Co., 195 Broadway, New York, N. Y.

Jenkins Fire Line Valves hold without leakage the water pressures at every hose outlet. These valves are fitted with Jenkins Renewable Disc and do not stick or corrode at the seat, but give a free flow in the emergency.

Made of bronze, with large hand wheel enamelled red. Furnished plain or polished in natural bronze or nickel plate. Sizes 1½, 2, and 2½ inches.

There is true economy in using Jenkins Valves throughout—years and years of dependable usefulness prove this economy. Valves in types and sizes for all requirements.

JENKINS BROS.

80 White Street, New York, N. Y.
524 Atlantic Avenue, Boston, Mass.
133 N. Seventh St., Philadelphia, Pa.
646 Washington Blvd., Chicago, Ill.

Always marked with the "Diamond"
Jenkins Valves
SINCE 1864

(*Continued from page* 38)

fitting. For small jobs such as rebabbiting bearings it is usual to do them on the job.

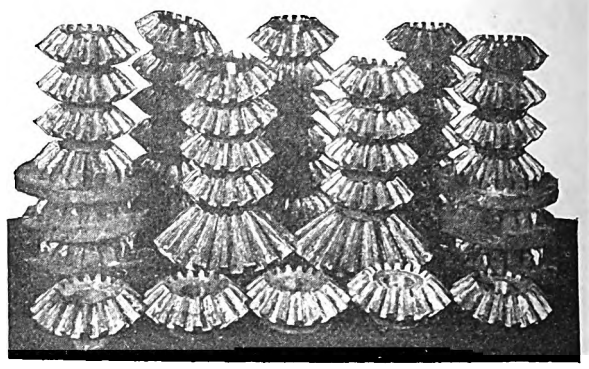
Breakdown repairs have to be made quickly and a stock of spare parts for all important units of equipment is desirable and necessary. These should be kept in the maintenance departments stockroom and when a part is used another should be ordered. When large parts break on cranes, elevators or other equipment a portable welding outfit is the most economical way to make the repair. If a forge shop is available new parts may be quickly made up. Sometimes it is necessary to mold new parts of cast iron or composition using the broken parts as a pattern. Spare parts should be held in stock for all breakable parts on elevators and cranes and for any other equipment that is considered as important as these. With a group of machines of the same design and size an ample supply of spare parts may be stocked without being considered extravagant. To facilitate quick repairs well equipped and fitted trucks are necessary to carry tools and necessary repair materials to the job. Often an electric truck is fitted up for this service.

A well organized inspection of the various units of equipment will go a long way toward eliminating breakdowns and will allow the repairs to be made in a systematic way before a break occurs. After the record system noted above has been in effect for a few years it is easy to have in stock most all the parts that are apt to wear out or become broken in regular service. Much of the work of this department is closely connected with the work of the millwright department. Especially is this so of the breakdown repairs on cranes, elevators and other large equipment on which work the two gangs often work side by side. It is therefore desirable to have close coöperation between these two departments so that the time for repairs will be cut to the minimum.

Motor trucks can be used instead of freight cars for the interstation movement of freight within terminals. The truck is a better vehicle for this service. It can do its work quicker and cheaper than the freight car.—*Prof. Emory R. Johnson, University of Pennsylvania.*

TAYLOR-WHARTON IRON & STEEL CO.

TIOGA STEEL & IRON CO. | WM WHARTON Jr. & CO. INC. | PHILADELPHIA ROLL & MACHINE



Gears of TISCO Manganese Steel

Spur, Bevel, Mitre and Herringbone. Ground or bush bore. Our pattern equipment provides for a wide range of sizes. These gears are well suited for rolling mill work, or wherever endurance counts.

Endurance — the absence of break-downs—that factor is closely related to dividends. TISCO Manganese Steel has become the standard for endurance.

TAYLOR-WHARTON IRON & STEEL CO.
High Bridge, N. J.



While Wharton Cylinders are made of the best materials, in the best manner—up to and beyond legal specifications—and sold at reasonable prices—

We prefer that they shall be sold and bought, not as so much material at a certain price, but *in terms of the service they render.* No Wharton Cylinder has ever failed.

Deliveries Prompt. Service Excellent.

May we send you full particulars and prices?

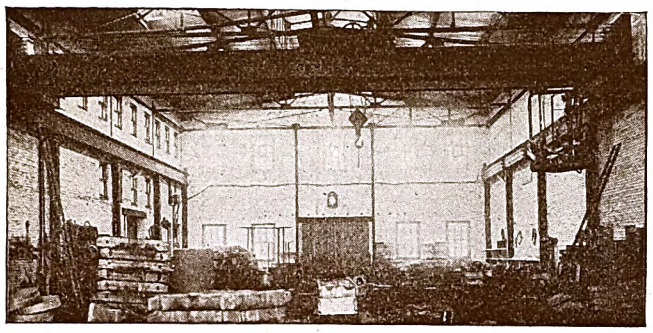
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30 Church Street, New York, U. S. A.

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Manganese Steel Wearing Parts, Special Trackwork, Cylinders for Gases, Hammered and Pressed Forgings, Rolls and Rolling Mill Machinery

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CRANES

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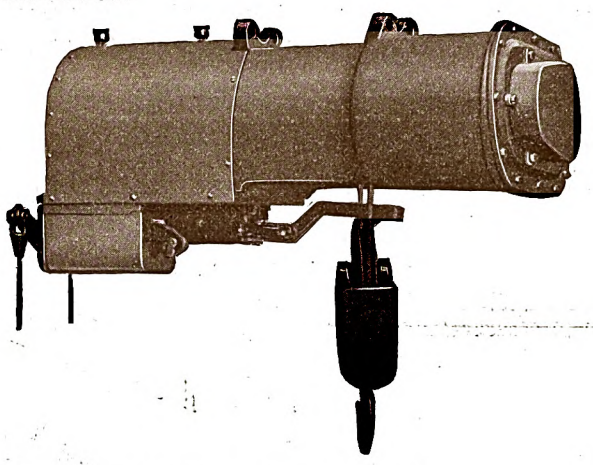
We build Hand Power and Electric traveling cranes, jib, wall and gantry cranes of many types.

Ask for Catalog 100.

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ELECTRIC HOISTS

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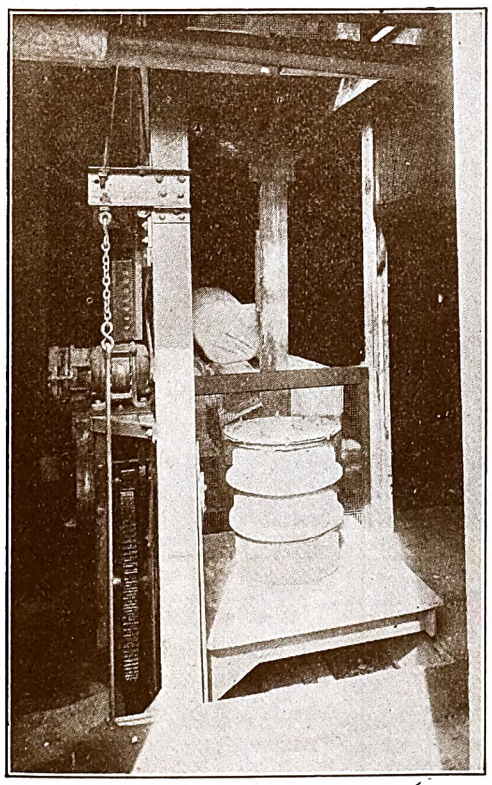
Cut steel gears and pinions running in oil.
Roller bearing. — Short headroom.
The construction is simple and built for service.

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That ELEVATING PROBLEM May be Solved by a Standard or Special "DELTA"

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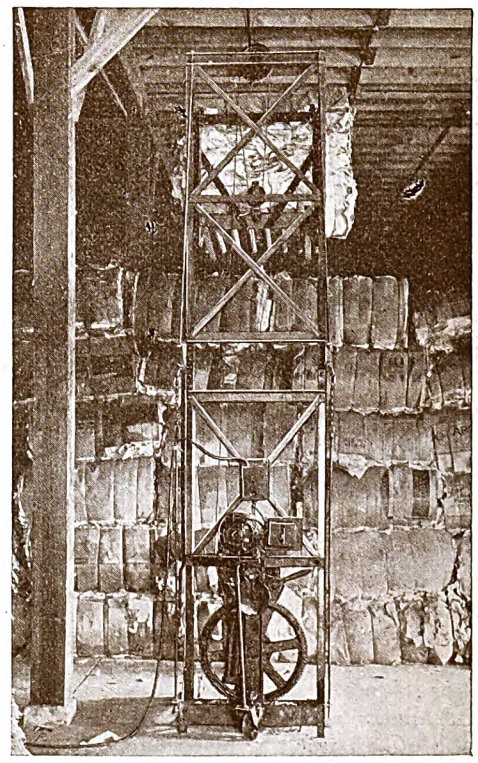


Electric machine with base in a pit used for handling to a mezzanine floor.

SINGLE DRUM, TWIN DRUM OR 4 POST MACHINE FOR PORTABLE OR FIXED USE.

CAPACITY—Whatever you need.
SPEEDS—Up to 80′ per minute.
PLATFORMS—Any size you want.
LIMITS—Electric top, bottom and intermediate if needed.
SAFETY—Does not depend on any mechanical adjustment.
SIMPLICITY—Mechanical knowledge is not necessary either to care for or operate.

Tell us what your elevating problem is and we will show you a DELTA for the purpose. We have 60 standard sizes, hand power and electric for prompt shipments.



Electric DELTA handling baled stock.

NEW JERSEY FOUNDRY & MACHINE CO.

90 West Street, New York City

80 Distributors **Incorporated 1885**

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Helping to Solve the Nation's Transportation Problem

(*Continued from page 22*)

and on the move to be a profitable investment. This can easily be accomplished by the use of one or more of the many forms of trailers which are applicable for the particular kind of commodity to be transported.

Trailers fall into four general classifications, according to type. (1) Four-wheel trailers; (2) two-wheel trailers; (3) semi-trailers; (4) pole or pipe trailers. The four-wheel trailers are subdivided into reversible and none-reversible types; light high speed trailers, for use with passenger automobiles, heavy duty trailers hauled by motor trucks for general haulage purposes, straight frame and drop frame models, and slow speed trailers with dump bodies for use in trains with tractors. Almost any type of body can be mounted on the four-wheel trailer, and many different types on the semi-trailer and the two-wheel trailer. The pole or pipe trailers are not intended to carry bodies, but instead are provided with bolsters to retain their load.

There is no doubt that in the majority of cases, industries are now paying excessive costs for their intra-plant haulage, which costs could be materially reduced by the use of some form of trailer. The Buick Motor Company, at Flint, Mich., should know the value of motor trucks, and the fact that they are using semi-trailers on their intra-plant hauls is more or less of an endorsement for such equipment.

Any vehicle that can be attached behind a motor truck or tractor is not necessarily a good trailer. Trailers should be designed and constructed with much care and skill, and the selection of the proper type naturally depends upon conditions and the commodity to be hauled.

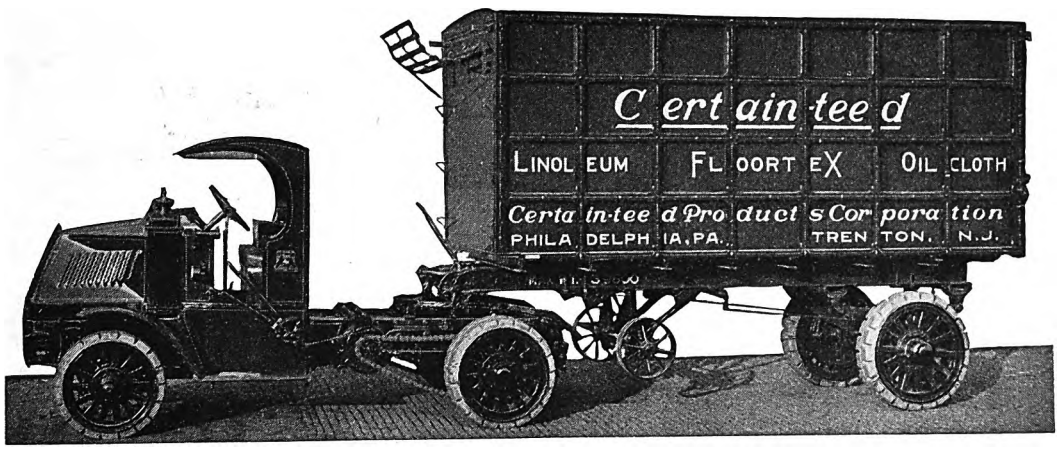
Trailers have six major functions: they increase load hauling capacity of the motor truck; reduce the cost of transportation, save waiting time for motor truck while loading and unloading; move objects that cannot be carried on motor trucks alone; take care of excessive loads and peak haulage; and enable passenger automobiles to be used for freight haulage purposes.

Great savings are possible by the use of trailers for hauling bulky materials, which take up a great deal of space in proportion to their weight. Trailers are also used to haul long lengths which will not go on the truck alone. The strongest arguments in favor of the trailer's use as an auxiliary to the truck are increased carrying capacity and reduced handling costs.

If one trailer is used it can be loaded while the truck is making a trip alone, and be picked up by the truck every other trip. Two trailers or two semi-trailers can be used to still better advantage while a fleet of three for each truck makes a very efficient hauling unit, especially where loading and unloading takes up a large part of the truck's time. In the latter case, when using trailers it may be found good practice to use the truck only as a tractor, and keep it in motion almost continously. One trailer

(*Continued on page 44*)

A STEP BEYOND THE TRUCK



Common Sense in Hauling Leads to

LAPEER SEMI-TRAILERS

Because they mean "Maximum Work at Minimum Cost"

When it is considered that the use of Lapeer Semi-Trailers means trebling the hauling capacity of the motor, reducing the hauling cost to one-third, and eliminating the idle time of motor and chauffeur during loading and unloading, it is understood why the motor truck, as a hauling unit, is giving way to the tractor-trailer method.

Those facts explain why the number of Lapeer users has been more than doubled during the last year.

There are, of course, the exceptional features of Lapeer equipment to be considered. The entire operation of Lapeer Semi-Trailers is controlled by the chauffeur from his seat in the cab of the tractor. Coupling and uncoupling are effected automatically, without the aid of any device. The semi-trailer brakes apply automatically, or the automatic brakes may be disengaged and the braking of the trailer entirely controlled by the chauffeur from the tractor cab.

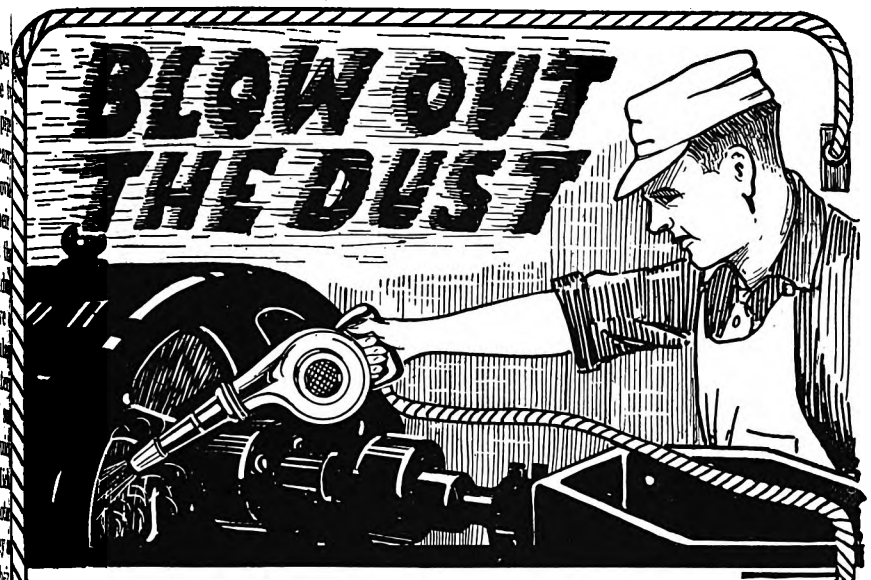
The Lapeer Semi-Trailer, when detached, is a complete vehicle, the front support wheel assembly enabling easy mobility by hand or otherwise.

We have prepared an interesting Folder (I-101)—Write for it.

LAPEER TRAILER CORPORATION
LAPEER, MICHIGAN

FACTORY BRANCHES: NEW YORK—PHILADELPHIA—BOSTON—DETROIT
DISTRIBUTORS: CLEVELAND—CHICAGO—ST. LOUIS—BUFFALO—LOS ANGELES—NEW ORLEANS—MILWAUKEE—TORONTO

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With a CADILLAC Portable Electric BLOWER

Your moving machinery is full of abrasive dust and grinding grit which is causing unnecessary friction, untimely deterioration, loss of power and heavy fire risks. There are countless particles of carbon in your motors, constantly threatening you with costly "short-circuits" and "burn outs." You can positively keep these destructive agents out of your machinery with a CADILLAC Portable Blower. **Its dry air cannot injure windings or insulation.**

There are hundreds of other uses for the CADILLAC Blower in your plant—where dust, saw dust and grindings accumulate.

Weighs 6 lbs.—attaches to any light socket.

Thousands in use in practically every line of industry.

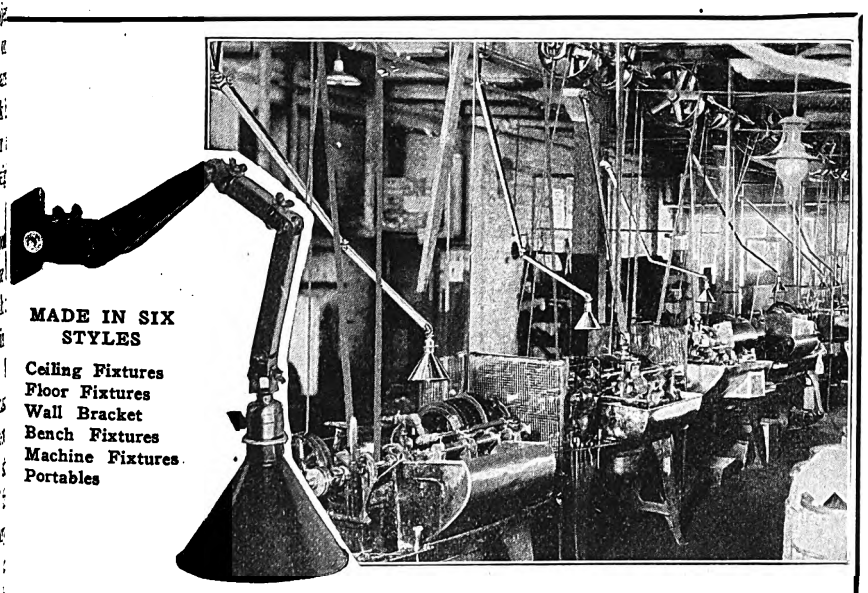
Write for descriptive folder giving prices, etc.

CLEMENTS MFG. CO.

Manufacturers of the Cadillac Electric Vacuum Cleaner

612 Fulton Street, Chicago

Canadian Factory: 76 Duchess St., Toronto
Export Department: 149 Broadway, New York City



MADE IN SIX STYLES

Ceiling Fixtures
Floor Fixtures
Wall Bracket
Bench Fixtures
Machine Fixtures
Portables

Better Light—More Work

Wasted motion, shadows cast by heads, hands and fingers, eye-strain and fatigue, breakage and "rejects" are costly production handicaps that can be immediately minimized by "American" localized light fixtures.

The universal joints permit the operator to place a good strong light in any position and hold it there indefinitely. Made of strong sheet steel, firmly welded at each seam, these units will last forever. Wires cannot become kinked; all danger of short circuits eliminated,—approved by Underwriters Laboratories.

AMERICAN FIXTURE COMPANY

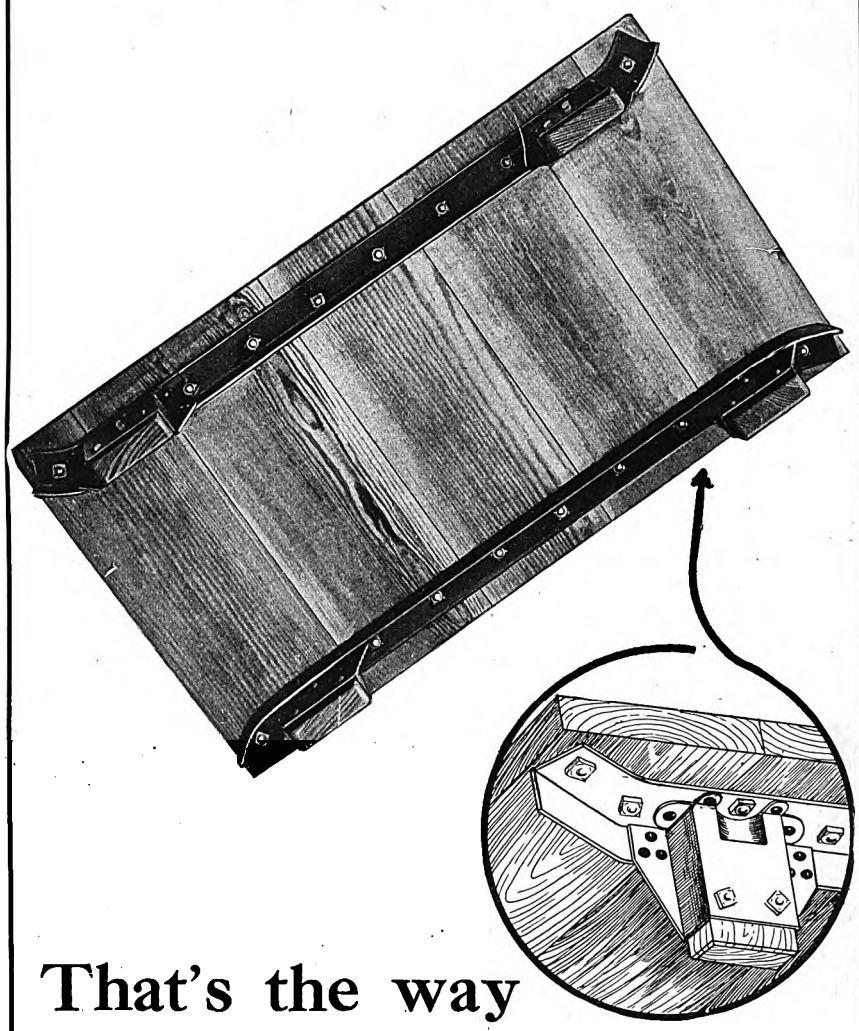
230 WEST WATER STREET

MILWAUKEE WISCONSIN



Send to-day for prices and catalogue.

From The Bottom Up

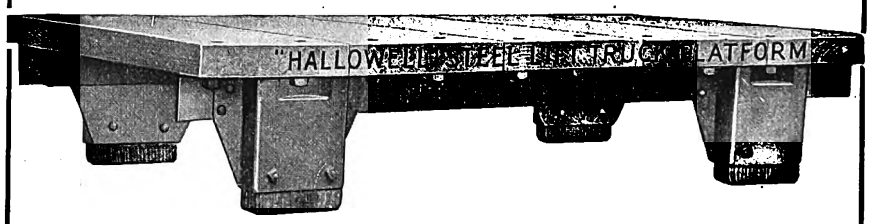


That's the way to judge Platform Values

That's the way we want you to judge "Hallowell" platforms. Forget all about the nice, shiny top and closely examine the parts that have to stand the strain.

Notice how the leg supports are attached to the runners—in the "Hallowell" platform *hydraulically driven rivets* are used; no bolts. This type of construction is the strongest yet developed.

There are three different types, "A," "B" and "C," making a very complete line; one or all of them will suit you.



HALLOWELL

STEEL LIFT TRUCK PLATFORMS

Made By

STANDARD · PRESSED STEEL CO.,

JENKINTOWN, PA.

(The "Pioneer" Steel Hanger People)

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(*Continued from page 42*)

may be kept at each end of the haul, while the truck is in transit with a third trailer.

The idea of semi-trailers as shown in Fig. 12, is to eliminate the carrying of the entire load by the truck chassis, and yet providing sufficient weight over the drive wheels to guarantee proper traction. The semi-trailers as shown are self-supporting when waiting for loading or unloading, but the front wheels are elevated from the ground as shown in Fig. 11, when the load is being transported. By using five trailers and two trucks, it is possible to keep the motive power continually in operation, and the delays for loading and unloading are eliminated.

Fig. 13 shows a fleet of trailers used by the Chicago Mill and Lumber Company, Chicago, Ill., for delivering wooden boxes. With these trailers, it was found that five trucks could do the work that formerly required 15 trucks. In order to insure quick shifting of the trailers (which in this case are supported on jacks at the front end instead of wheels) when the trucks are out on delivery, an auxiliary front wheel as shown in Fig. 14 is employed, and the team of horses shown in Fig. 13 are hitched to the tongue, thus making the trailer into a wagon. Attention is again called to the method of supporting the trailer on a jack instead of wheels, as shown in Fig. 12. The third type of trailer support is shown in Fig. 15. The method of supporting a trailer should be given careful consideration.

On long hauls it is frequently more economical to use a four-wheel trailer which is coupled to the motor truck, and loads are carried both on the motor truck and on the trailer, as shown in Fig. 16. Industrial plants having branches in different cities, or where it is necessary to transport materials partly finished from one plant to another a considerable distance away for the final finishing, have found this type of trailer very efficient.

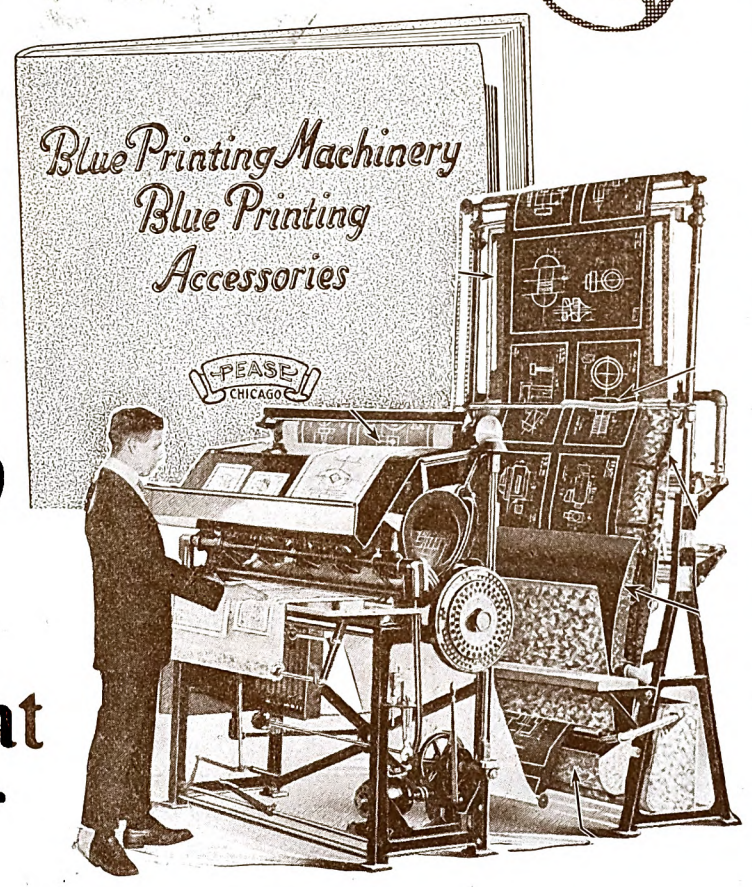
The load on the chassis guarantees the proper weight over the drive wheels for traction and the pulling of the loaded trailer requires very little power. As an example, Fig. 16 shows a four-ton trailer and a three-ton truck loaded with 12 tons of oranges, leaving Lindsay, Calif., for Sacramento. Overloads of this proportion are not recommended, but it shows the possibility of the motor truck and trailer system.

Fig. 17 shows the manner in which the Long View Orchards at Wenatchee, Wash., haul their apples to market. By using trailers, they have doubled the hauling capacity of their trucks, and it has been found that they have saved considerable time, and while the operating costs per truck have increased from 20 to 25%, they have made an enormous savings because it is not necessary to operate so many trucks.

Demountable bodies are preferred by some instead of trailers, although they are not similar equipment, as with demountable bodies the entire load is actually carried on the truck chassis. However, they permit as quick loading and unloading in the majority of cases as do trailers, and the operation is similar, *i. e.*, while the truck is busy conveying a loaded body to its destination, the second body is being loaded at the point of shipment, and the third body is being unloaded at the destination. Three things are happen-

PEASE

Save 75% on Blue Print Costs-



This Book Will Show You How

The secret is in the Pease Peerless Blue Printing Equipment which completes three operations in one; printing, washing and drying. The process is so simplified, so rapid, involves such a minimum of labor and operating expense that the Peerless turns out four times as many prints in one hour with one operator as can be turned out on any other equipment, where independent methods of washing and drying are used. Thus you will reduce your blue print bill 75%.

OUR CATALOG explains the whole story in detail. It illustrates and describes the various Pease Equipments and contains many dollar saving ideas for your blue print room. If you want to make more and better blue prints in less time, at one quarter the cost, it will pay you to obtain a copy of Catalog M-28.

SHALL WE SEND A COPY TO YOU?

The C. F. PEASE COMPANY
828 N. Franklin Street, Chicago, Ill.

"Largest Manufacturers of Blue Printing Machinery in the World"

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ing at the same time: loading, unloading and transporting. Upon arriving at its destination, the truck discharges its loaded body, takes on the empty body and returns. The empty body is exchanged for a loaded body in a very few moments, and the process is then repeated, keeping the truck and driver constantly engaged in actually moving goods.

In other cases, only two demountable bodies are used, and one is being loaded while the other is delivering its load in small orders and on numerous stops.

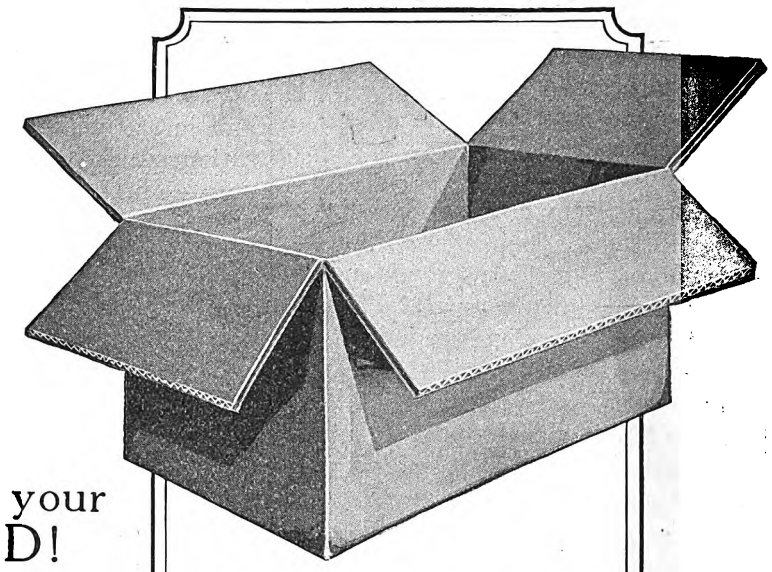
There are different types of demountable bodies particularly as to the method of placing upon, or removing them from, the truck chassis. Figs. 18, 19 and 20 show the method employed by a large paper concern for handling merchandise between factory and consumer. Fig. 18 shows the truck backed into place at the loading door. Fig. 19 shows the body being pushed forward on the overhead framework, while Fig. 20 shows the entire body supporting unit and method of loading bodies to trucks. Another view of similar equipment is shown in Fig. 21. In this installation the loading platform is inside the building and the trucks back into the building for loading, instead of pushing the body outside of the building on an overhead framework. In this installation more than 100 hand-chain blocks have been rigged up so that they are electrically operated. Each unit consists of four 2-ton chain blocks which are hooked on to the corner of the body so that the body can be lifted free of the chassis. The bodies are left hanging as shown, and are loaded or unloaded in this position. Attention is called to the method of supporting the body hoisting unit on I-beam trolleys so as to permit a slight longitudinal travel in case the truck does not back under in exactly the proper position to receive the body.

Building construction will not always permit the installation of overhead rigging, and so demountable bodies have been designed to operate on casters or wheels resting upon the floor. A wholesale grocer in Sioux City, Iowa, operating the equipment shown in Fig. 22 for delivering from warehouse to stores, has found that it is possible to use three trucks for 12 bodies. The particular design shown is arranged in such a way that by turning a hand crank, the truck driver can pull the body on to, or back it off of the truck chassis.

When using demountable bodies, the important thing is to properly arrange for the loading and unloading platform. Fig. 23 shows an ideal layout for the industrial plant, as it requires very little space.

One of the most difficult problems in the use of demountable bodies operating on casters or wheels instead of overhead supporting unit, is the proper aligning of the truck chassis with the platform, so as to receive the body without considerable shifting and to insure the body wheels running in the tracks on the chassis frame. Another objection is the blocking of the wheels and the levelling of the truck chassis with the loading platform when unloading filled bodies. One manufacturer of this equipment has designed a locking and truck aligning device which fastens to the loading platform and absolutely locks the chassis up and levels it

If there is a *Better Way* to Pack, H&D Will Find It.



BETTER boxes---for your products? Ask H & D!

If your shipments are not reaching their destinations safely---if freight costs are too high ---if it is taking too much time to pack---draw freely on the special box designing department of America's largest manufacturer of Corrugated Fibre Boxes.

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No obligation--- and no cost. H & D Packing Engineers will be glad to work out the simplest, safest and most economical manner of packing your merchandise. If there is any way in which your present methods can be improved, you can learn of it, free of charge from H & D.

Tell us what your problems are---or, better still, send in a sample shipment of your goods, (charges to be paid by us) and ask for H & D packing suggestions. A new container will then be designed for you, your shipment placed in it and returned together with a cost estimate of the box in any required quantity.

Take the first step toward improved packing today. Mail the coupon---or write to the H & D Service Department.

The Hinde & Dauch Paper Co.

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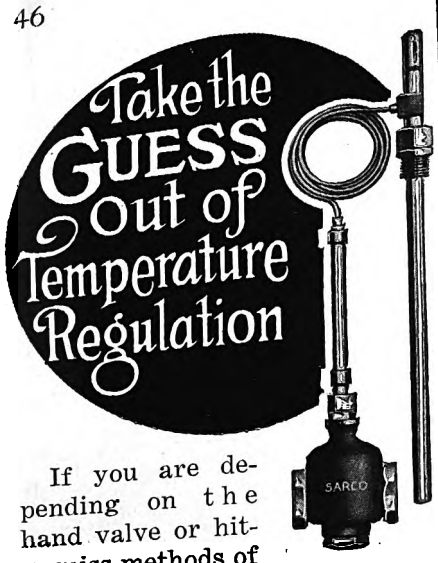
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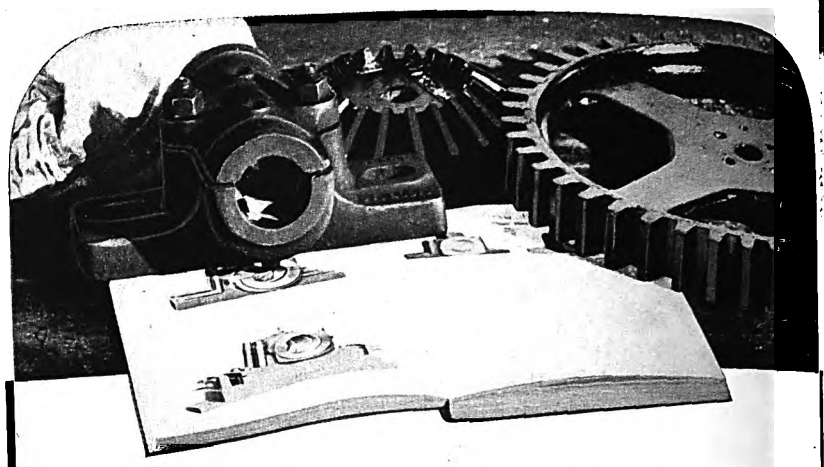
with the platform. This device can be seen at the end of the truck in Fig. 24, while Fig. 26 shows the locking jaws and the method of supporting this demountable body on the truck chassis.

The equipment from portable loaders to demountable bodies is applicable in almost all industrial plants, and will help to solve the motor transportation problems, but back of all these smaller problems looms the one big problem of future transportation. If we can solve that one big problem, and decide upon and install a national transportation system which will incorporate highway, railway and water transportation with the least possible friction and the highest possible efficiency, we will have solved a thousand smaller problems at one sweep.

The industrial executive is vitally interested in this big problem and as it is practically an economic necessity to reduce present costs of distribution, we should therefore consider the future of motor transportation in its broadest aspects.

Motor transportation can hardly be considered as a separate entity for its very existence is interwoven with that of the railways and waterways, and its future will of necessity be influenced by them. The railroads have been with us a long time, and have been proven satisfactory means of transportation for handling both passengers and freight over long distances. The motor truck has been with us long enough to establish its right to the short haul, although some question its right to the long haul. In order to refute this impression, we show in Fig. 25 a fleet of trucks in transit, which are employed by a national moving concern for long hauls. It is not unusual for trucks of this type to transport individual loads from New York to Chicago, and from New York to Buffalo, and on similar hauls of long distance. A number of these trucks have made trips covering 4,000 miles, before returning to the operating base. There are also many large industrial concerns transporting goods for a distance of from 100 to 200 miles, between factory and large cities.

These examples of actual operation open up a wide field for the motor truck on long distance haulage, and by using the accessories of semi-trailer, detached trailer and demountable



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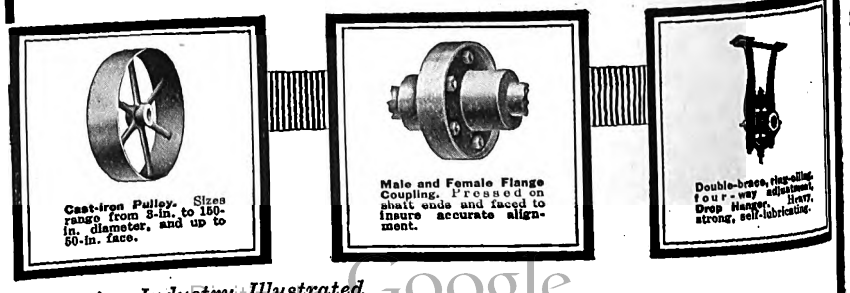
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odies, the possibilities of the notor truck can be greatly enarged, and while it is not feasile for all trucking companies nd industrial plants to operate rucks on the long haul, these nstallations which are in successful operation indicate that he motor truck has its place in he national transportation system.

The conception and installaion of the container cars shown n Figs. 29-30 (and on the cover f this magazine) is a big step oward solving the country's ransportation problem. The se of this class of equipment neans saving time, less confuion, damage and money in ransportation, but it means hore than that. It means real fficient coöperation between rucks and railroads, a consummation greatly to be desired. he mission of the container car s to expedite delivery of less han carload volumes of freight. ts use calls for coördination of arriers, steam and electric railoads and motor trucks.

The container cars have many dvantages: (1) the eliminaion of the handling between hipping and receiving points, 2) eliminates the need for ostly crating; (3) they also nake necessary the use of fewer heckers and clerks. (4) Then, oo, prompt unloading to motor rucks eliminates demurrage. 5) Their universal use would ermit industrial plants to be loated irrespective of the proxinity of railroad tracks, and vould do away with the expense f spurs and sidings.

In Europe for many years the ectional or demountable freight ar has been employed, and an llustration of such a car is hown in Fig. 27. This car carries two demountable containrs, and has been operating for ome years handling crushed arbide between a large carbide lant in Switzerland, and a fertizer plant in Bavaria. The racticability of the container nit is here demonstrated, beause carbide is one of the most ifficult materials to handle, due o its affinity for moisture, hich must be carefully guarded gainst as moisture in contact ith carbide forms acetylene as which is explosive.

It will be noted that the uropean railway cars are much maller, being not quite one-half he size of an American flat car. Many of the industrial executives who went to the front will ecall the size of these cars. The efficiency of the idea, however, has been proven, and an American railway system known as the Detroit United lines is now employing like equipment, and coördinating the motor truck and the railway. Fig. 29 shows demountable bodies ready for unloading to the platform where they will be transferred direct to flat cars especially constructed to hold the containers in place, it being possible to place four of the larger, and eight of the smaller on each flat car.

Furniture, mail and express is handled on the continent of Europe and in England by this system, often using automobiles, boats, and railway trucks all during one trip.

Similar equipment, but of heavier construction is also being used by the United States Government for the transportation of mail between New York and Chicago. This month's cover shows the heavy construction of these containers, and the method of unloading same from flat cars to mail trucks. Each flat car can carry four or six of



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Here is a source of increased dividends well worth serious thought. Sturtevant catalog B291 tells how pneumatic conveying systems may be used in many industries.

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these containers, depending upon the size used. The containers used for mail are made of steel and besides being fire and weather proof, are made burglar proof, by setting them on the car in such a manner that the doors, even if they could be unlocked, cannot be opened without hoisting the whole compartment above the steel bulkhead behind which it fits.

Interchangeability is the keynote of Success, and this demands standardization, not of the transportation units, but of the containers which will be interchangeable by each and all.

The limiting factor in this chain of coördinating waterways, highways and railroad transportation is the motor vehicle, and since the greatest trucking economies are obtained through moving the maximum load, containers should be to the maximum of truck capacity. The unit container in itself makes possible enormous motor truck operating economies for our common carriers, as it will conserve the high cost of truck idle time now paid by shippers in tariffs covering the costs of truck operation by present practice.

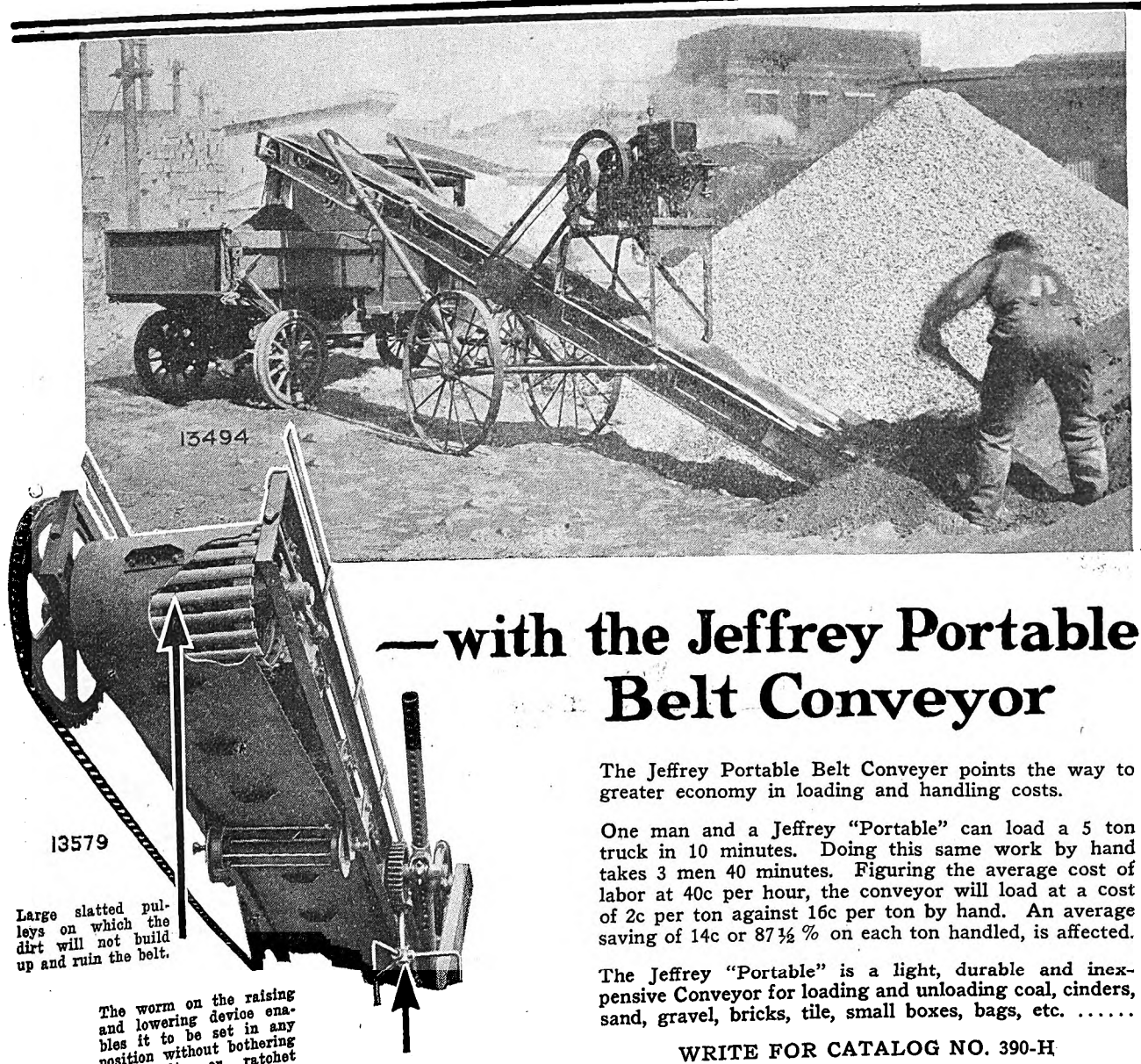
In addition, with such possible trucking economies, enormous labor conservation and money savings will accrue to the carriers when this equipment is put into universal operation. Thus the container can be made the Missing Link in transportation, for it can be made to lace up into one comprehensive system, for through movement, all existing disjointed units.

By present practice, there is much cross and back hauling of empty gondola cars, allotted to certain commodity freight service. The gondolas can be utilized for merchandise freight service with the container as an accessory for transportation, and their empty returns, now at a total loss, can be converted into profitable merchandise transportation movements. In the motor truck, our common carriers have now available a supplementary unit for their transportation plan. To date the consideration of such by the carriers has been limited almost exclusively to complaint of its inroad on their business, and in the hand of wild-cat operators on their tariff expectancies.

In other words, the interest of the railroads in the motor truck has been destructive instead of constructive. The potency of the motor truck will ultimately force railroad executives to adopt and use it as an adjunct to their own facilities. It is therefore necessary for progressive plant executives to understand the true value of the motor truck, and its proper place in the national transportation system so that they will be prepared for the new conditions which will shortly exist. And they should be in a position to converse intelligently on the subject.

Within the last two years the American people have begun to realize that the proper solution of the immigration problem is a matter of vital importance to the country. An article in the January issue of the *Monthly Labor Review* entitled "A Century of Immigration" shows the menace to our national principles and ideals involved in the vast tide of immigration, which in the past fifteen years has amounted to nearly 10,000,000 persons.—*U. S. Department of Labor.*

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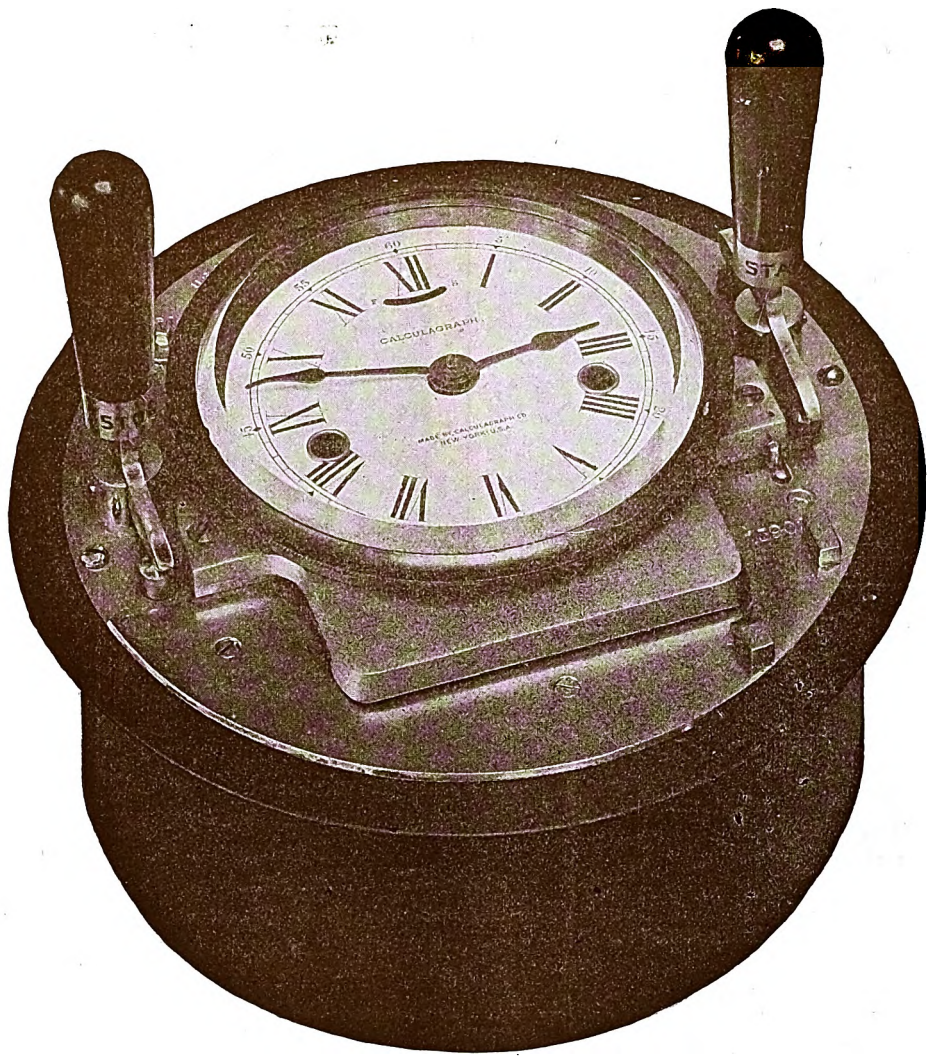
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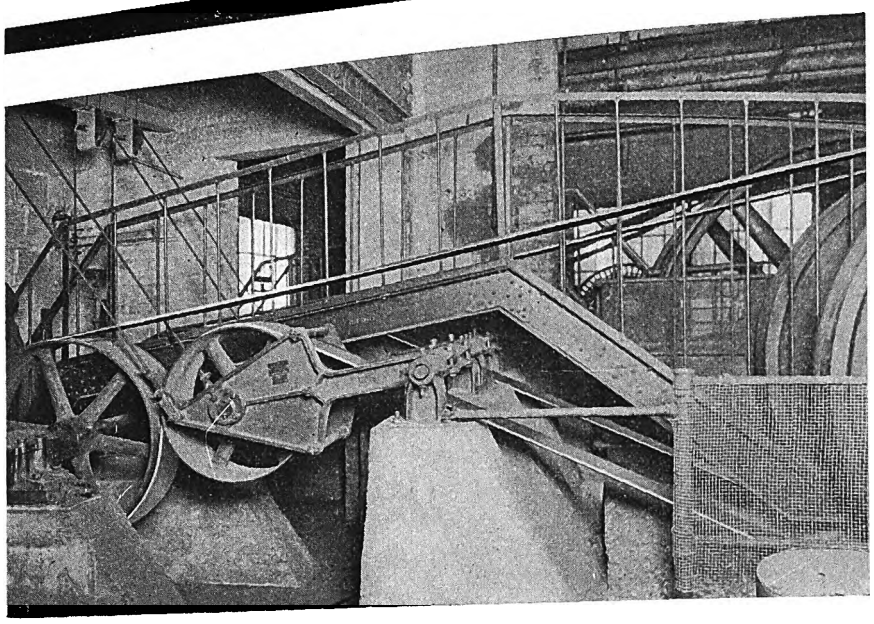
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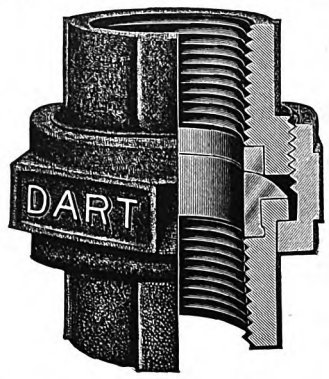
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Electric Welding and Its Applications

(*Continued from page* 28)

is scarcely a welding method, being limited to the production of the necessary heat. The process is sometimes termed the water-pail method. A wooden tank is filled with some suitable electrolyte—as, for example, sodium carbonate or potassium carbonate. In the liquid a plate, which is connected up with the positive pole of a source of current, is immersed. The work which is to be heated is connected up with the negative pole and then immersed in the electrolyte. The passage of the current heats the work. When the temperature is judged right, the work is withdrawn and the actual welding effected by hammer and anvil or some equivalent means of producing compression.

The art of uniting metals by means of the heat created at the seam by the resistance of the seam to the passage of the current is, it is in effect claimed, an American development. It appears that Elihu Thomson conceived the fundamental idea as far back as 1877. But his first patent was not obtained until 1886. This is a mechanical method, being more or less dependent on compression. Apparently, there is no purpose to create an arc, but merely to develop the heat by simple resistance to the passage of the current. When an arc is produced, we have a stream of fine particles passing from the positive to the negative electrode. Whatever constitutes the positive electrode, whether the work itself or a rod, this electrode supplies the material out of which the arc is made. The stream of particles is incandescent and is presumably the chief source of the heat used in the welding. With resistance welding, no arc is necessary. No stream of heated particles is sought or required. The heat is developed locally because the current is hindered at the seam by the reduction in conducting capacity.

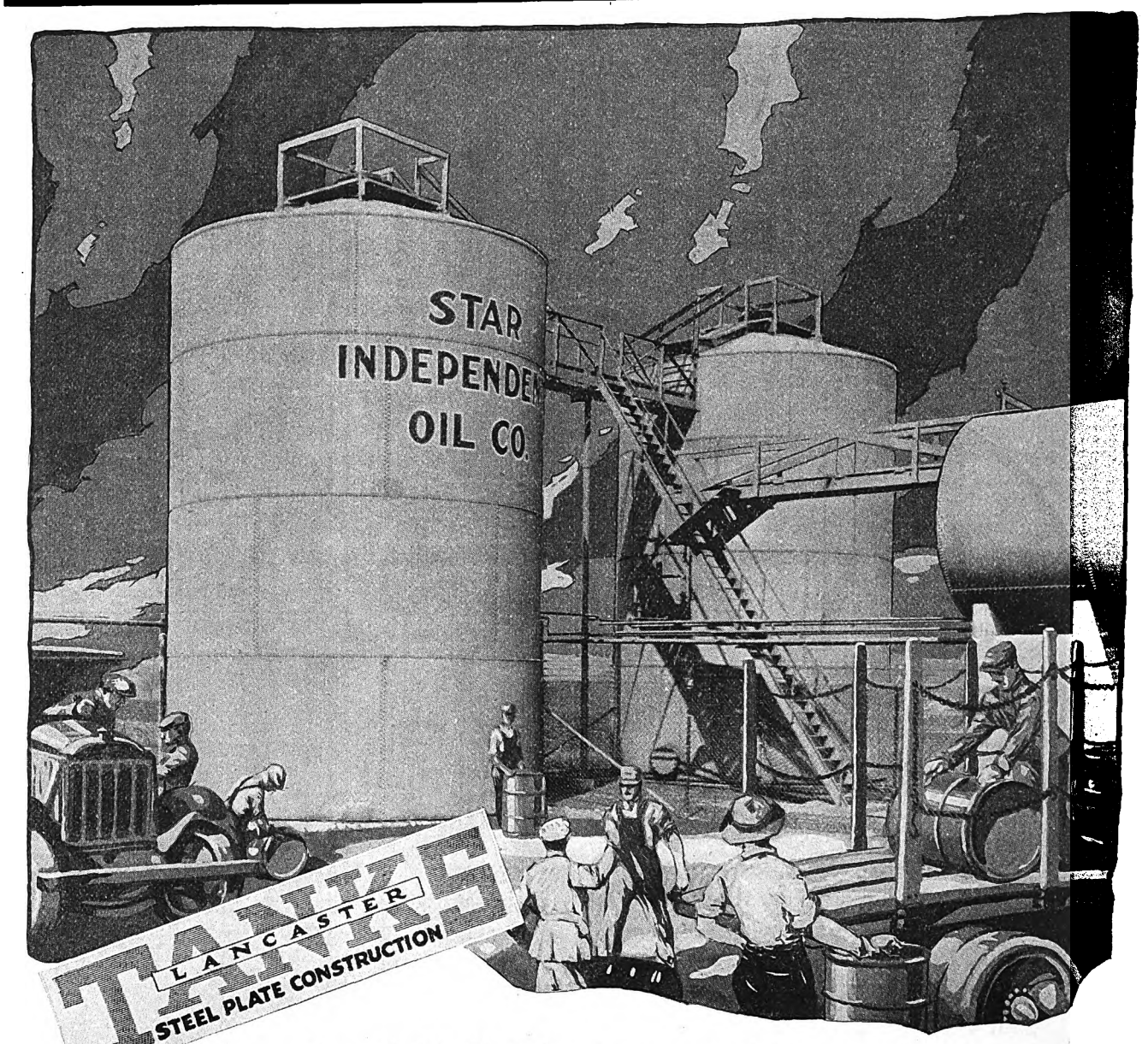
In the early stage of the development of resistance welding, it was found that the jaws of the machine which held the two parts which it was desired to unite, required artificial cooling, which was supplied by a system of water-cooling.

Resistance welding may conveniently be regarded as divisible into butt welding, spot welding, point (or projection) welding, ridge welding, and seam welding. What is known as percussive welding is an additional form, which may be classed with the other processes of resistance welding.

Apparently, Thomson's first patented device (1886) did not provide for pressure at the moment of welding but depended rather upon fusion and maintained contact. It is said that a patent, issued in Germany to De Bernardo in 1888, was probably the first to cover the matter of electric welding under pressure.

At the present day, resistance welding is chiefly carried out by the aid of machines. Alternating current may be used in certain devices, particularly machines employed in butt welding. In fact, single-phase current of practically any usual commercial voltage and frequency—as,

(*Continued on page* 53)



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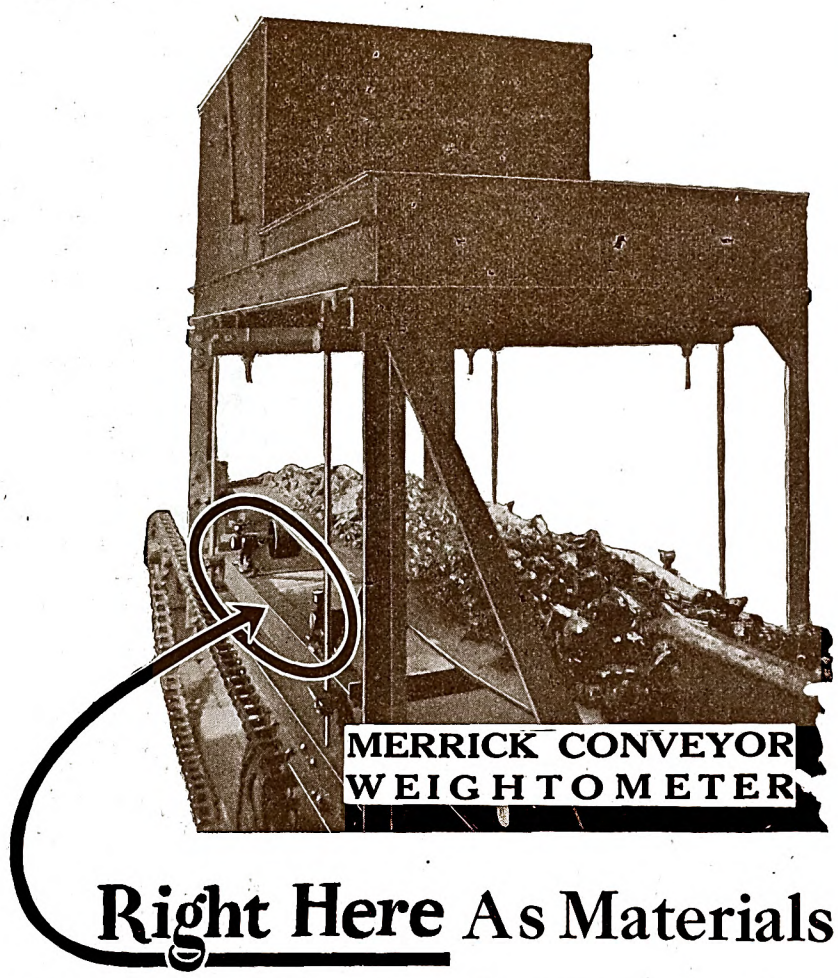
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". . . we are now unloading and loading more cars and trucks than we could possibly have handled promptly in the old days, and we have reduced our yard gang from *38 men a year ago to 27 men today*, with shipments and incoming materials running slightly heavier than a year ago today."

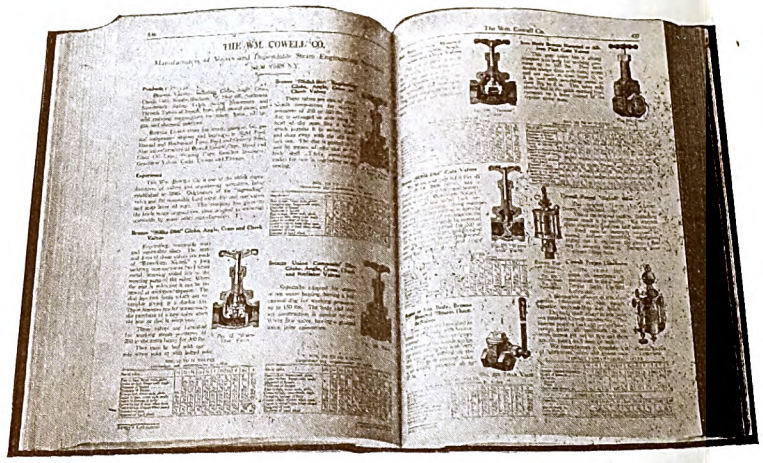
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(*Continued from page* 51)

220, 440, or 550 volts, 60 cycles —may be employed.

The two general processes—arc and resistance welding—have their respective fields, which doubtless overlap more or less. But we need both processes for the work that may very well be done by electricity.

In general, direct current is employed in welding by the arc process. It is explained that with the alternating current, the heat developed at the ends of the arc—that is, at the electrode and at the work—will be the same. This is to be considered as inherent in the very fact of alternation. With the direct current, on the other hand, the current is always going in the one direction. The result is that considerably more heat is developed at the positive electrode than at the negative.

There are certain claims that have been put forward on behalf of the advantage properly belonging to arc welding that have practical importance. In the first place, if a metallic electrode is employed—presumably with direct current—welds may be made overhead and in vertical situations. That is to say, the arc may be made to carry metal from the electrode into the location of the weld and thus build up without difficulty an overhead or vertical seam, the effects of gravitation being effectively overcome.

The arc method is competent to weld steel, cast steel and cast iron. This seems to be a limited list. However, these metals are so universally used that the field is still a very large one. Those interested in the nonferrous metals will naturally note the exclusion of copper, brass, aluminum, etc. It is possible that some development may have been made along these lines, but I doubt if matters have gotten to a thoroughly commercial point.

Another advantage claimed for electric arc welding is the high temperature available. It is estimated that this temperature lies between, say, 6000° and 7000° F. The reader who has not sufficiently considered the question may wonder why so high a temperature may be desirable. The thermal level is, indeed, much higher than that required for the melting of the metal. But high temperature appears to be the only thing capable of producing *in the metal of the work* enough heat to melt it, when so unsubstantial a means as the electric arc or the gas flame is employed. Quantity of heat and a moderately high temperature are both requisite to fuse the metal.

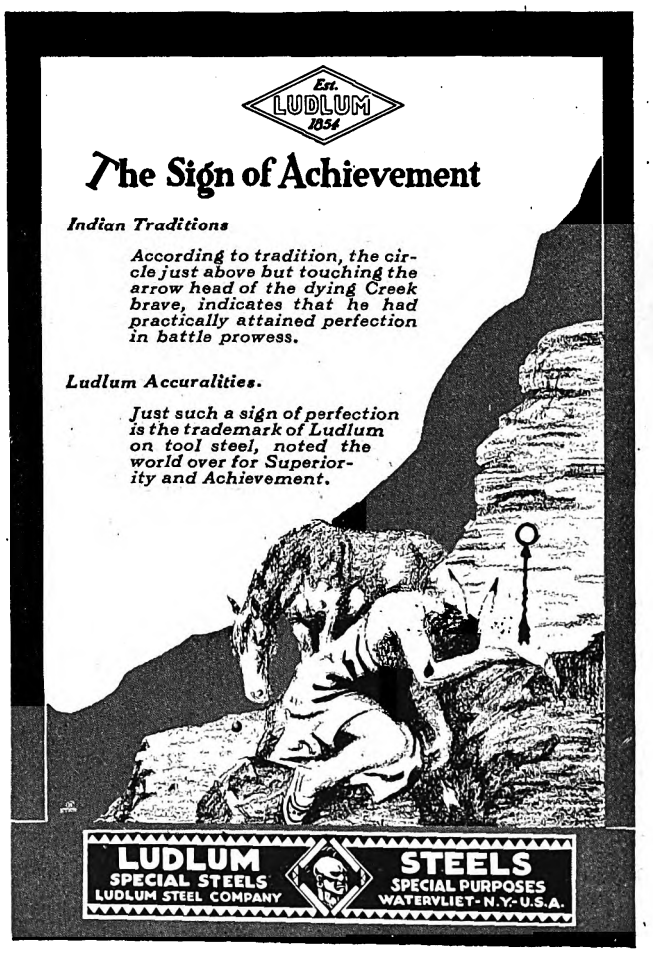
In so inconsiderable a weight of material as that which constitutes the arc or the gas flame, the quantity requirement can only be met, apparently, by using an excessively high temperature. We have here the apparent reason why the oxy-acetylene process seems to be superior to the oxy-hydrogen procedure, when welding is in contemplation. At or near the terminus of the little white pencil-like flame of the oxy-acetylene torch, we get a temperature understood to lie between 5000° and 6000° F. The inconsiderable weight of material in the arc, accordingly, means that we must have an excessive temperature in order to get the amount of heat required.

One of our largest companies manufacturing electric equipment supplies arc welding appliances, whose operation is based on the one-carbon system. However, instead of the hard carbon formerly employed, they substitute graphite. The electrode is baked at a temperature of about 3600° F. and in consequence the binder employed is graphitized. This is said to improve the bond between base and binder and also the homogeneity of the whole electrode. It is claimed that the substitution of graphite results in a lower consumption of electrode material and in a softer weld (*i. e.*, in a weld containing less carbon).

It will be of interest to have before us some of the important details concerning the arc formed with this type of electrode. After the arc is once formed, one end of a rod of suitable metal may be introduced into it from the side. The object is to supply fresh metal for use in making the weld. The arc carries metal from this rod down into the hollow of the welding surface. This hollow, or crater-like formation, is created by the arc.

Imagine the arc extending from a tapered graphite electrode to a crater or hollowed out place in the metal of the work. In general, it is advantageous that the electric connections of work and electrode be such that the work is positive and the electrode negative. This gives, usually, a higher concentration of heat at the end of the arc next the work. In fact, this concen-





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tration of heat may often be used, if desired, to cut through the work.

Now, the arc may be manipulated so as to be long or short. It is recommended that short arcs be employed. The reason is interesting. The arc stream consists of two parts—(1) a central core, and (2) an enveloping sheath. The core will be a white, and the envelope a blue. External to both will be a yellow flame. The arc stream consists of a central core of electrically charged particles and an envelope of hot gases. The electrode material is conveyed in both liquid and vapor form across the arc, a spray of small globules being discernible with some types of electrodes. Since atmospheric gases tend to diffuse through the incandescent metal stream, it is obvious that some of the conveyed material becomes oxidized. Through the maintenance of a short arc, not exceeding ⅛ inch, the resulting oxidation is a minimum because enveloping metallic vapors serve as a barrier to restrict the further diffusion of atmospheric gases into the arc stream. However, in practice, oxidation is wanted, as it is by means of it that the carbon from the graphite electrode is oxidized and thus prevented from impregnating the metal of the weld. If impregnation were allowed, hardness of the metal in the weld would result. The length of the arc required for the consumption of the carbon varies with the amperage of the current employed. On the other hand, the arcs must not be too long, as the protective envelope is then liable to deflection and the exposed stream of metal to oxidation. For a current of 500 amperes, the arc should generally have a length between ¾ and 1½ inches.

It is claimed that the graphite electrode may be used in the arc process for the welding of cast iron, cast steel and non-ferrous metals. Further, it is also claimed that cast iron may be cut, and also cast steel and non-ferrous metals. The cuts are rough and apparently consume a considerable quantity of the metal. This will be of small importance in certain cases—as, for example, in those where the risers and rough fins on castings are to be cut away. Other claims refer to the melting and cutting of scrap metal, the remelting of a surface to improve its appearance, to the deposition of hard metal or the hardening of a surface by impregnation with carbon, and the automatic cutting and welding of sheet metal. It is also said that the process may be used to preheat the metal of a welding job for the purpose of taking care of expansions and contractions.

We are not to conclude, however, that the arc process employing a graphite electrode monopolizes all the foregoing applications of the electric arc in connection with welding and cutting. Other arc processes cover much the same field.

Cutting with the electric arc is quite different from the cutting process carried out by a high-pressure oxygen stream acting in conjunction with a heating operation carried on by an oxy-hydrogen or an oxy-acetylene flame. The gas method seems to act in part by a destruction of the integrity of the steel brought about by the oxidation of the contained carbon and perhaps also by an oxidation of the iron as well. With the electric arc, the cutting action seems to consist principally of



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calized melting. The cut is made because the metal fuses and blows away. The operator, consequently, advances the arc just the rate at which the metal fuses and flows out of the cut.

The following details will give an idea of certain features of arc cutting. Two 8-inch cuts were made in ship plate ½ inch thick. In the one case, an arc made by a 250-ampere current was employed. A cut about ½ inch wide was made in 2½ minutes. In the other case, a current of 650 amperes was employed with the result that a cut .8 inch wide was made in 1 minute.

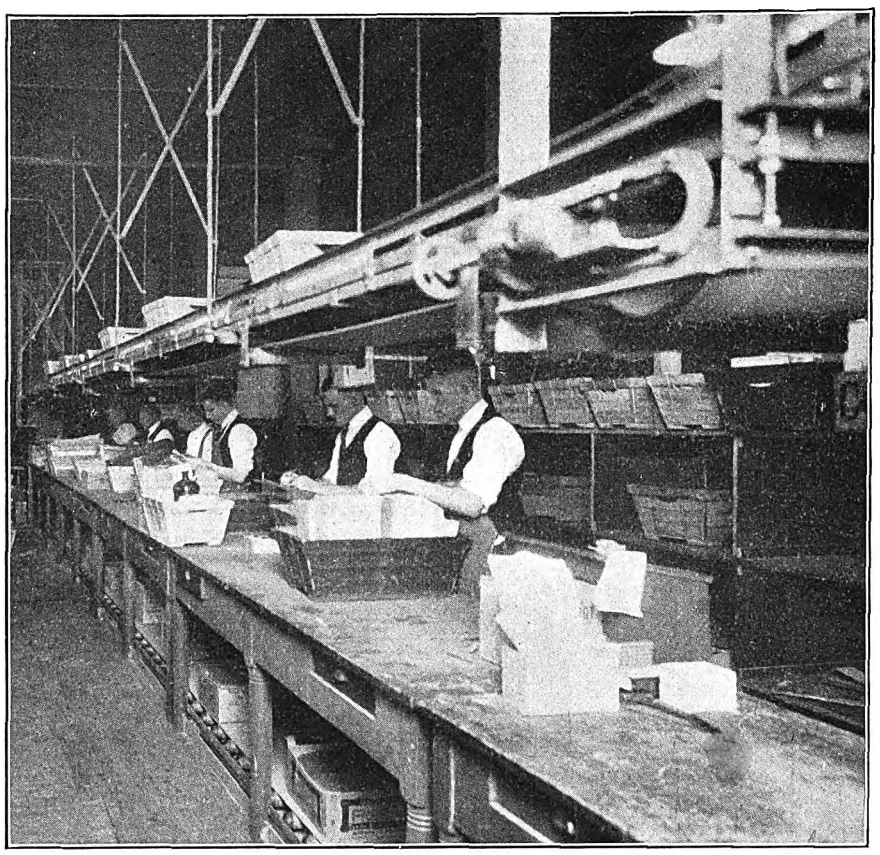
A great advantage of the arc method of cutting consists of the circumstance that non-ferrous metals may be cut. In fact, cast iron may be cut with the arc. A particular application, of importance in the operation of blast furnaces, consists in the "burning out" of tap holes and the melting or cutting of iron which has "frozen" in furnaces of this kind.

As to the welding of copper and copper alloys, the use of the arc appears to be yet in the early stages. When the oxy-acetylene process was first introduced into the United States, it appears that some expected that all metals could be welded, and a certain amount of disrepute was perhaps acquired because of a failure to appreciate the special problems due to the physical and chemical characteristics of copper. Just how far along the arc people have gotten, is not apparent. Copper welding with the oxy-acetylene flame is now pretty well developed.

Other non-ferrous metals—as, for example, aluminum—that are of importance in the industrial world have their individual characteristics just as well as copper and the copper alloys. And these characteristics play roles of greater or less importance in welding operations. So that it is necessary to study the various metals and to take into account their individual peculiarities, if electric welding or any of the new methods is to be employed with them. In this matter, it may be that the oxy-acetylene people are further along. And doubtless, some of their experience will be of value to the electric people. It is said by the company already referred to that copper and bronzes (alloys of copper and tin) have been successfully welded by means of the arc method, using the graphite electrode. A welding rod of bronze low in tin and zinc is mentioned in this connection. It is also required to be high in phosphorus—not less than 0.25 per cent. being specified. This last is undoubtedly a provision against oxidation of the copper, the phosphorus acting as an oxygen absorber.

Of what material or materials should the electrode consist? This has been a very live question among those interested in arc welding. From what has already been set forth, the reader may gain the impression that at least one large concern has committed itself to the carbon electrode—that is, to the electrode made of carbon in the graphite form. Another concern, claiming to be the largest welding organization in the world, says: "According to our experience, we believe that the chemical composition of the electrode is of less importance than a uniform granular structure. The physical properties of the electrode affect the stability of the arc more than they do the

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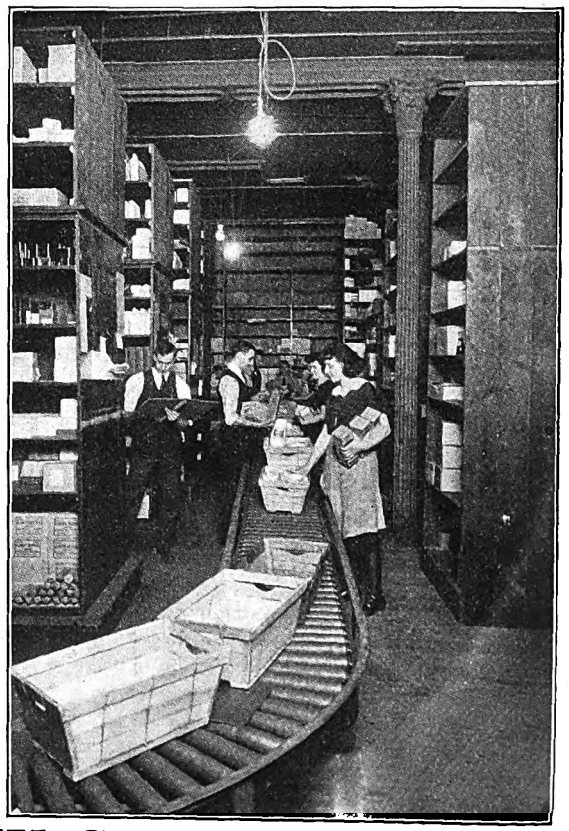
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physical properties of the finished weld."

Some electrodes are used bare; others consist of metallic rods covered with a coating or sheath of fluxing material. "It is found that flux coatings are desirable in many cases, partly on account of their stabilizing effect on the arc and partly on account of their value as fluxes in cleaning the weld of certain impurities."

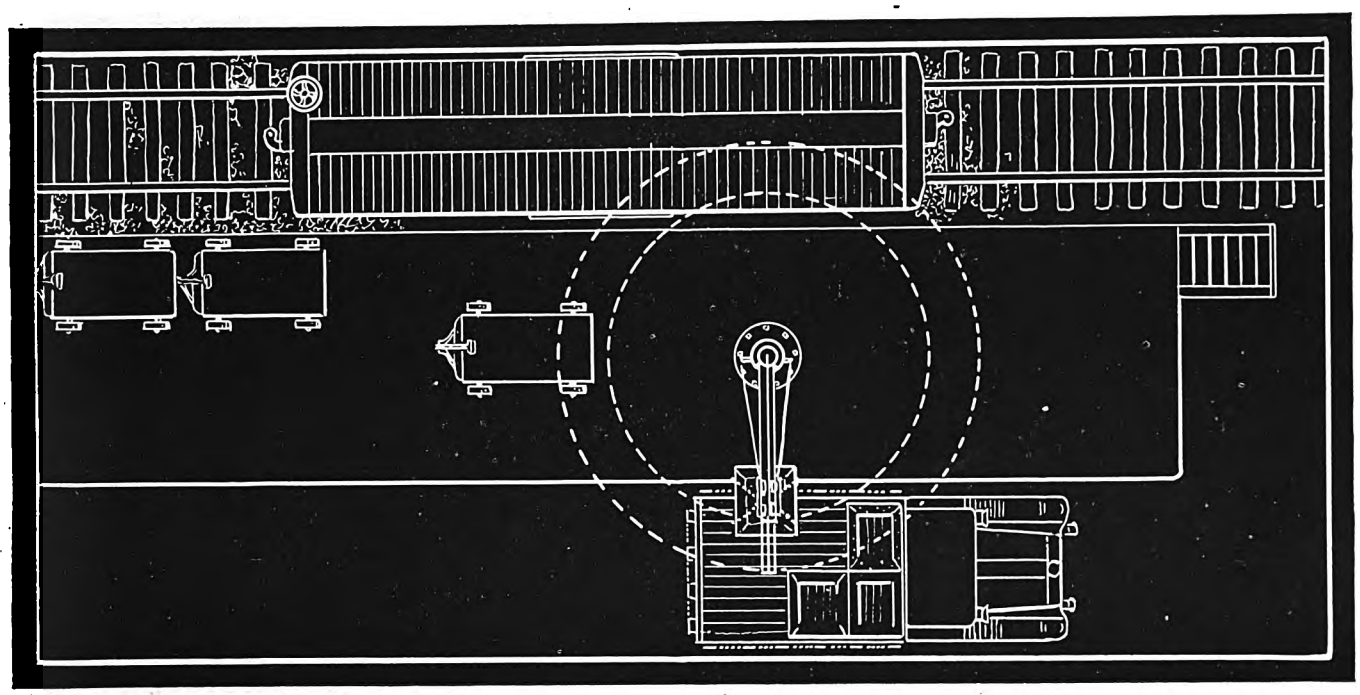
We are to understand the foregoing to refer particularly to iron and steel. "When it comes to welding bronze and other non-ferrous alloys, the choice of material in the electrode is of great importance." And further: "There is so little known of this branch of the art that those who know consider it the best policy to hold secret the little knowledge they have."

Let us, however, consider briefly the metal electrode. With this type of terminal, we do not need a special welding rod as a source of supply of fresh metal for the weld. The electrode itself is the source of supply. Metal melted from the electrode is deposited in and becomes a part of the weld. We have here a situation somewhat different, apparently, from that which exists when using the graphite electrode. We find that under this system, the amperage of the current controls to a large extent the length of the arc. When a metal electrode is employed, it is apparently not so much the amperage of the current as the situation of the point at which new metal is to be deposited. Shortness of arc is desired as a means of minimizing the oxidation of metal flowing from the electrode. But situations arise where the welding is to be done on a projection or down in a deep and narrow gap. Here a long arc is desirable, because such an arc enables the operator to maintain the arc while manipulating the metal. "The stability of the arc and the tenacity with which it persists increases with the length."

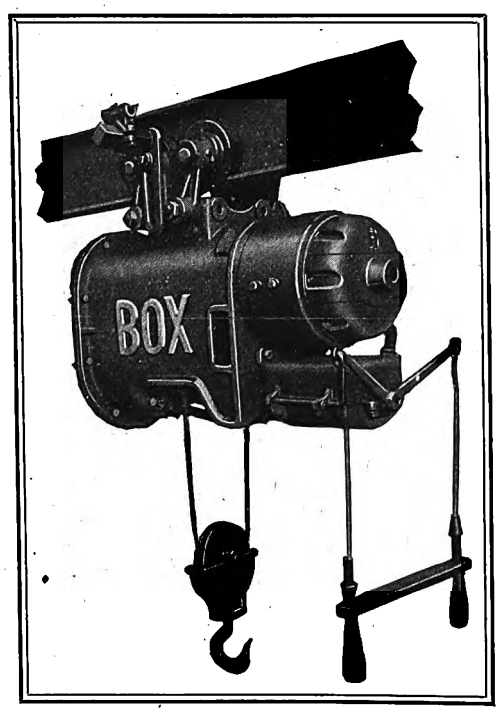
The diameter of the metal electrode is a matter of importance, since in general it is easier to make a good weld with an electrode of small diameter. The reason given is that, with a small electrode, the operator is compelled to carry the arc all over the surface of the joint. If the welder has a big, powerful arc, it is rather easy for him to get a good flow of metal and fill up the joint without going over all parts with the arc.

It seems to be pretty well understood that successful welders operating with the electric arc require training. It is not an art which just any common laborer can acquire. Intelligence is required. To intelligence must be added information and experience. There are schools for the training of operators. Then there are opportunities for learning the art as an apprentice or helper.

Electric arc welding can be applied to an exceedingly large variety of work. Broken castings, whether new or old, may be restored. The running of seams connecting up plate metal is a class of work to which the arc is adapted. In structural steel work, the arc finds opportunities. An example or two will illustrate this class of job. A structural steel column consisting of an H-bar is to stand on a base plate. Arc welding is applicable here in securing the base plate to the foot of the column. Again, a crane bracket may be wanted for supporting an overhead traveling crane.



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The bracket itself may be secured together by the electric arc and then by the same means affixed to the supporting column. Standard steel shapes may be cut so as to form the peak of a roof truss. The parts may all be joined together by arc welding.

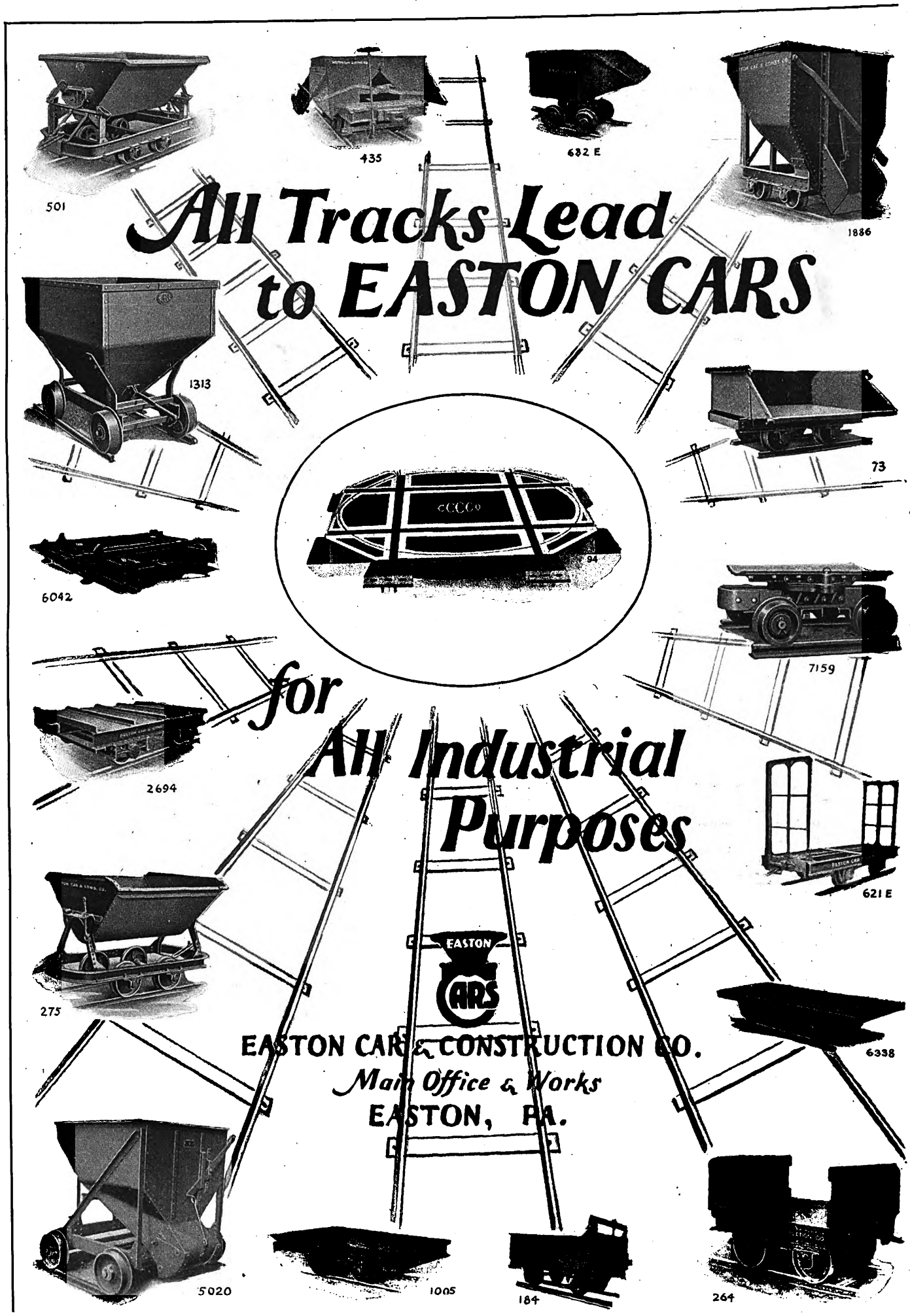
What has been described as the pioneer job in the welding of new construction was carried out in connection with the celebrated Catskill Aqueduct, which supplies a large part of the water for New York City. Far up in the State and on the west side of the Hudson River, the aqueduct crosses the Rondout Valley. The concrete tunnel lining had failed under test. It was proposed to use a certain type of circular reinforcement in meeting the situation. But how were the big steel rings to be gotten into the tunnel and put in place? The solution of this problem was materially facilitated by the arc process of welding. The rings were cut up into three sections each and later on welded together again. In this way, the work was successfully carried out. To join these rings by bolting or riveting was out of the question as far as tightness, strength and permanence of joint were concerned.

Just as has been the case with the oxy-acetylene process, the arc welding system has proved of great value in connection with *putting on metal.* An illustration of this kind of work will give us an idea of its usefulness. On ships, the hawse pipes through which the anchor chains pass suffer excessively from abrasion. Under the circumstances prevailing only a few years ago, frequent renewals had to be carried out. Now, it is possible to effect repairs with arc welding. The operator uses his arc to build up the worn places in the hawse pipe and thus restore the original contour.

An example of the use of the metal electrode in connection with *vertical welding* is afforded by the case of a cylinder belonging to a marine engine. It was one of two vertical cylinders and had been severely scored by the up and down movement of the piston. Only a partial dismantling was required in order to enable the restoration of this cylinder by means of arc welding. Twenty-six places were repaired in the one cylinder.

The tightness of the joints made by the fusion system is one of the most valuable features. In illustration of this matter in connection with arc welding, I may cite the case where it was proposed to use an old tank bottom as the head of a fuel oil tank. The old piece contained a lot of perforations—168 rivet holes, 8 pipe holes, 1 hand-hole and 1 man-hole. These were all filled and the head secured to the tank. We have here a splendid instance of filling in, welding in plate, and welding up the main seam. In fact, the various rings of this storage tank were welded together from the inside.

There are on the market a number of portable outfits. These may be moved about from place to place and require nothing additional except a convenient source of current. Or, the portable outfit may include the means of generating the current. Thus, it may have on board the truck a gasoline engine connected up to drive a dynamo and thus produce its own current. One or more of these portable outfits may be used with alternating current. Such machines



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as these portable affairs make it possible to go to the job and thus do a good deal of work more conveniently than would otherwise be the case.

There is an advantage that is claimed for the alternating arc that may find a place here. According to one manufacturer, the direct-current arcs make welds that are either electro-positive or else electro-negative. "In either case, there is a liability of a voltage couple being formed with consequent electrolytic corrosion, especially in damp places." The claim is to the effect that this situation is avoided when the alternating-current arc is employed.

Where direct-current equipment is to be used and only alternating current is conveniently available, the problem may be solved by employing a motor-generator set. That is, the alternating current operates a dynamo which in turn generates direct current.

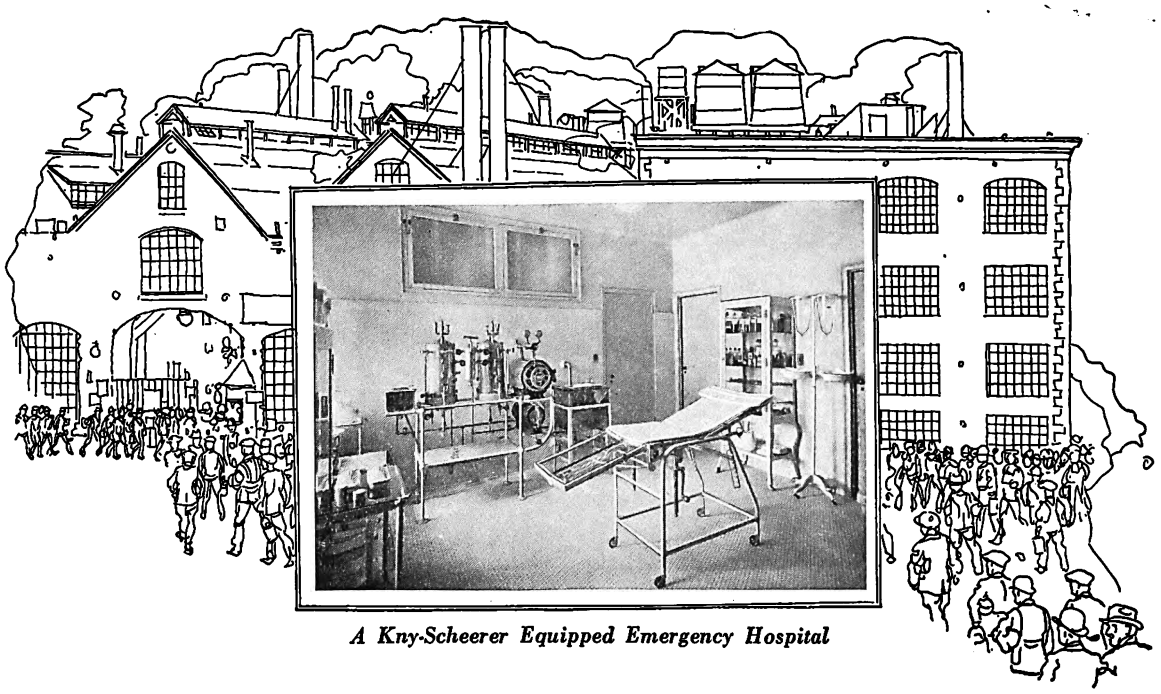
The concern making portable, alternating-current outfits regards bare electrodes as rather obsolete and gives its preference to coated ones. These people also claim that cast iron may be deposited from a suitable electrode.

I shall not have space to go into this matter in much detail. Resistance welding is largely confined to manufacturing operations. Machines are employed to perform certain classes of work and these are operated in the performance over and over again of essentially the same thing.

The *spot welding machine* may be mentioned as a type that is largely used. In illustration of the work performed may be cited the manufacture of mowing machine cutter bars. These are long affairs with triangular cutting pieces. Forty-one spots are welded per bar. Some at least of these spot welds involve three thicknesses of metal—two 1/16-inch thicknesses on top of one 3/16-inch thickness. It is understood that 25 such bars may be welded every hour on one of the recent machines.

Butt-welding machines are used to effect the welding of joints where there is a continuous contact area between two surfaces pressed together at the moment of welding. One machine of this type deals with small welds, the area of contact being specified as limited to a maximum of 0.4 square inch, the maximum thickness of pieces to be ½ inch. A square rod, 0.6 x 0.6 in cross-section, which is to be united end to end with another rod of the same size and form, would call for a butt-joint of a size within the capacity of this machine. The production possible may vary from 35 to 85 welds per hour. Another butt-welding machine is designed for operation upon iron or steel wire of a size varying from No. 16 to No. 8 (B. & S.) on separate pieces or hoops over 8 inches in diameter; or to No. 12 on smaller hoops, rings or buckles. The production possible with this machine may be stated as 800 to 1,000 small separate pieces per hour—buckles and rings. If the pieces are long and separate, the production is reduced to 500 or 600 per hour.

Still another butt-welding machine has a capacity which may be stated thus: Pipe joints may be made of sizes running from 2-inch diameter to 8-inch diameter. This machine operates on iron or steel. The work may consist of many other things besides pipe joints. Thus, rims



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Just two points of this many angled subject, but both are well worth a second reading.

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y be the thing in contemplation. If so, the capacity of the chine varies from rims 6 x ¼ hes up to rims 18 x ¾ inches. om 30 to 100 rims may be ded up per hour, the exact nber varying with the size condition.

On these butt-welding maines of this and similar types, ood deal of pressure is rered. In the present case, 30 s standard pressure is exed upon the metal at the nt by means of two 15-ton cylder jacks operated from an umulator outside the maine, this accumulator having apacity of 1,200 pounds per are inch. The jacks may be rated with oil or water, but ferably with oil.

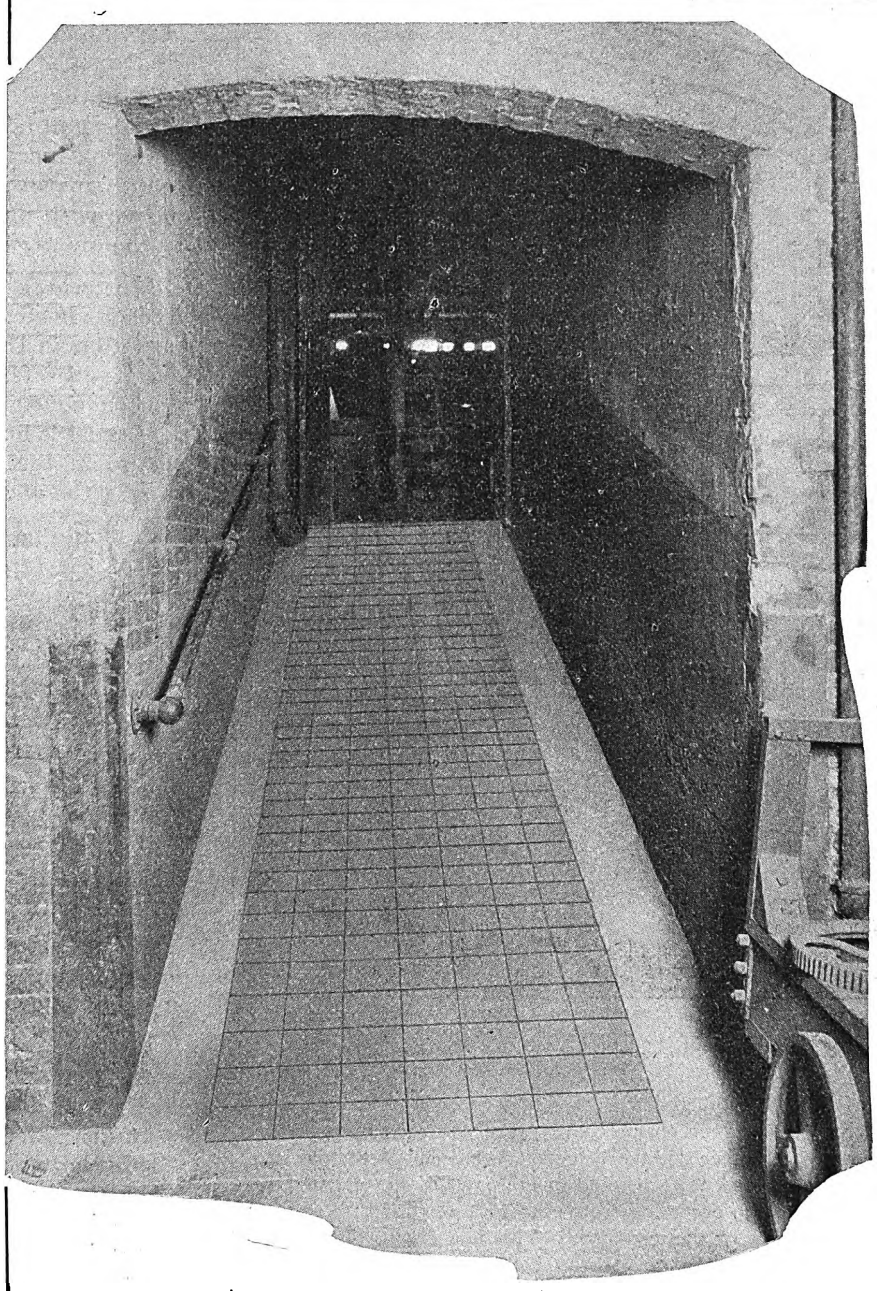
Take another butt-welding chine. This apparatus is caole of handling steel boiler es from the 1½-inch size to 4½-inch. On this machine, st of the 5-inch super-heater es may be welded if the secns are reduced at the location the weld. From 35 to 60 welds y be made per hour, the operon including a rolling down the butt after welding.

The *seam welding machine* is another piece of apparatus pendent upon resistance weld. With a representative mane, pressure is exerted on the ler by a series of springs loed on each side. It will be n then that for the class of rk handled by this device the tter of pressure does not asne formidable proportions. e thickness of the stock is ited at the maximum end to . 20 gage (B. & S.), and the gth of the seam to 24 inches. ass and zinc sheets may also welded on this machine, the ximum gage being No. 24. e production accomplishable ends upon the length of the m and also upon the adaptaty of the jig. However, 30 ms may be taken as the nimum per hour and 120 as maximum.

A seam welding machine built another concern is said to dle seams of 4 to 5 feet per ute when the gage thickness ges between No. 16 and No. Such a machine may be d in running seams in pails, ite lead containers, lard conners, grease pails, and the .

A far western concern has ought out a spot welding mane having a capacity for a le range of work. It seems t what was sought, at first, was a machine capable of meeting the severe requirements of manufacturers of metal cabinets, boxes and the like. It was desired to weld in corners inaccessible to the ordinary machine. But, apparently, they have pushed the matter further and produced a spot welding apparatus capable of dealing with pretty much all descriptions of work. In short, they regard this machine as a universal apparatus. The cycle of possible adjustments is so large that the machine may be set for particular work of many kinds and thus used as a special machine on each of the several classes. Naturally, the machine may be used now for this job, now for that.

Spot welding is not to be regarded as a method of uniting metals that has but limited application. This is not the case. Many of the metal products of today would have to be made in an entirely different way, without the electric spot welding process, and the increased cost in time, money and material would render their manufacture unprofitable.



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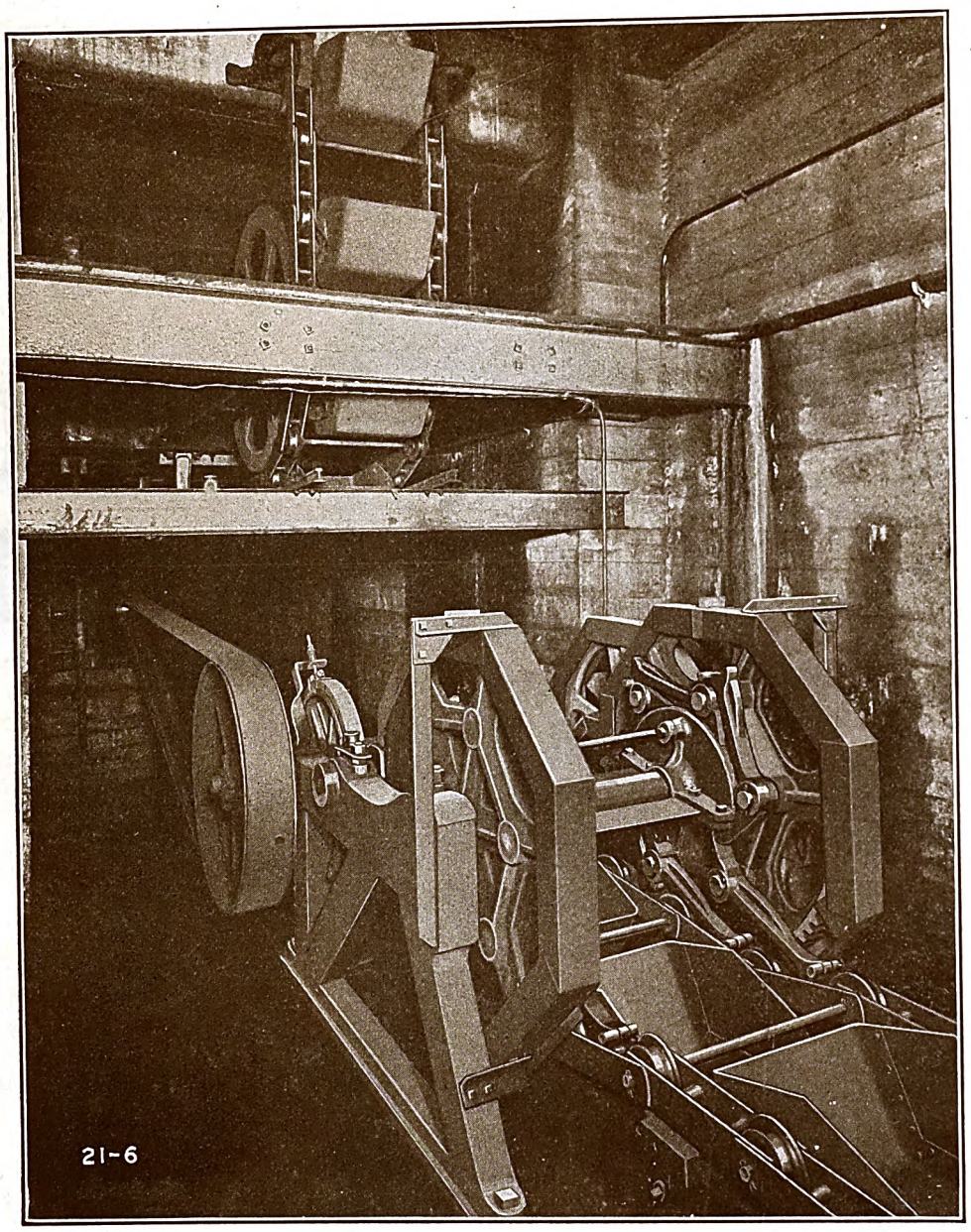
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The thrifty squirrel in the Fall, when nuts are plentiful, stores away his savings in holes in the ground and in hollow trees, to tide him over the Winter, when provisions are scarce. Other animals live on the fat of the land while the living is good, with no thought of the lean days to come.

Business executives can take a lesson from this thrifty little quadruped in the matter of coal storage. When coal is plentiful and conditions are advantageous, bunkers should be filled to capacity. Dependence on the hand-to-mouth method in providing only for present needs, with possibly a small reserve, is doubtful policy.

Mutterings of another coal strike in the Spring are already heard. Yet,—to quote from an article in Industrial Management, February issue,—"In face of reports of another Winter coal shortage, production records show that more coal is being mined and shipped than ever before in the history of the industry, except during the war and immediately after."

It would be a wise plan to emulate the example of the farsighted little squirrel and make provision now against the days of shortage.

Hunt Cost-Cutting Equipment has for over half a century been instrumental in forestalling coal shortage by reason of its facility and adaptability in storing and rehandling coal; thus permitting a wider range of temporary storage spaces as well as the regular bunkers. Ashes are handled with equal facility.

Hunt Engineers with their long years of experience and a vast amount of data accumulated in over half a century, can plan a system that will operate as efficiently, economically, and give as long service as it has done in numerous plants all over the world. Learn a lesson from the squirrel and prepare for the future. Begin Today!

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A Challenge to Main Street

(*Continued from page* 13)

nticipated to take place in that ocality.

Naturally, the first develop- ent beyond the old-time fac- ry dormitory was the company wn. The chief characteristic of ese company towns was their niformity. The possibilities of rchitectural and town planning emed either not to have been nown or to have been neglected.

Textile manufacturing is not ampered by the handicaps hich surround such enterprises s mining, which must locate here raw materials are found nd are always faced by the ossibility of exhaustion of the pply and cannot afford to es- ablish anything other than a mporary community.

One manufacturing concern fter another has found that f t e r spending considerable oney in bringing employees rom other cities, the majority ave not stayed because they ould not find suitable homes in hich to live.

Shawsheen Village owes its xistence to the enterprise and ublic spirit of William M. Vood, president of the Ameri- an Woolen Company, who tarted the construction of omes here in 1918 to relieve he war-time housing shortage hich seriously affected em- loyees of the corporation. Mr. Vood was thoroughly familiar ith the various stages of hous- ng which had prevailed in New ngland, from the dormitory tage, through the hamlet of uildings all alike adjoining the actory, to the development of ndependent communities.

He had become convinced that roper housing makes working en happier and more content- d, and reduces absences due to ickness—that it makes workers uch more efficient and reduces he number of floaters. He knew rom experience that proper ousing has helped to avoid trikes — that it has increased he number of individuals and rganizations taking an interest n the betterment of social con- itions. He had become con- inced that the houses must not e located in the shadow of a reat factory. Too close prox- mity to the work makes the mployee feel that he is living nder the scrutiny of his em- loyers and that even his home s part of a big machine or in- ustry. This restraint naturally akes him restless.

There is more incentive to buy property that is part of a general community than where houses are too close to the factory. Becoming part of a general community develops a permanent class of labor.

While employees will welcome arrangements whereby, through wholesale buying, building materials and effective erection costs have been reduced, and these reduced costs made available to employees, they will oppose as a repulsive arrangement any plan which puts housing on a charity basis.

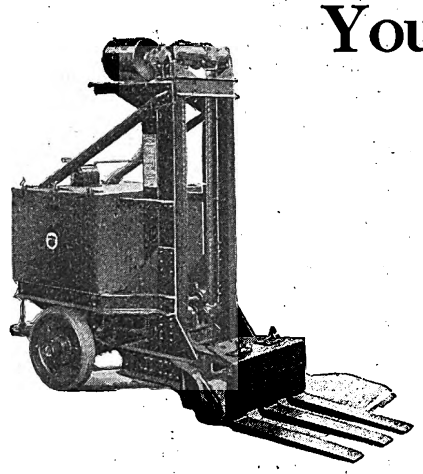
To bid for labor in the open market solely on the basis of wages, tends to a disorganization of the labor market, and if continued long, ends in an industrial conflict.

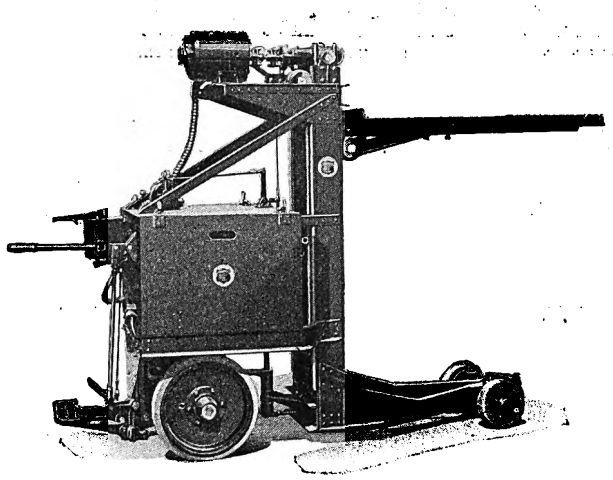
Eligible real estate companies do not as a rule consider the building of working men's houses a profitable enough in-

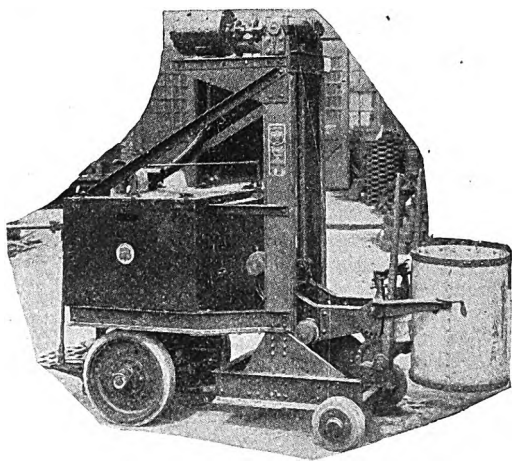
The Latest "Tier Lift" Principle?

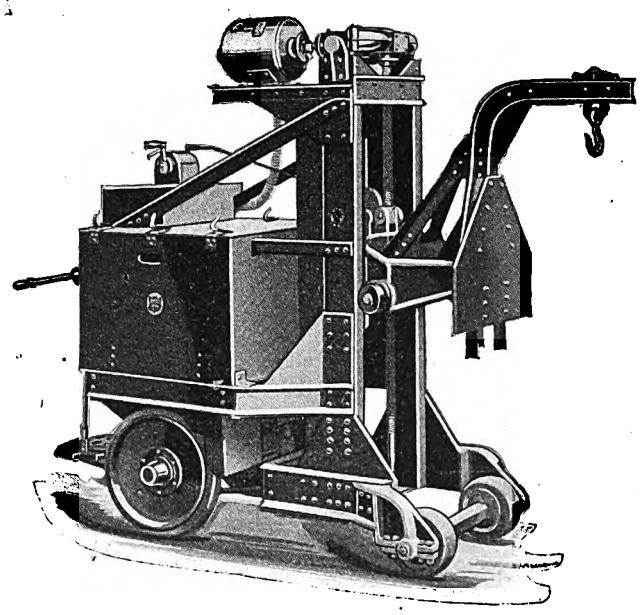
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We shall be glad to assist you in making a material handling layout of your plant and recommend the equipment you need.

Writing involves no obligation.

The Lakewood Engineering Co.

Cleveland, Ohio

Originators and Patentees of the "Tier-Lift"

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vestment to interest them. This leaves the field open for speculators and exploiters who either build a flimsy house to sell at the price of a substantial one, or promote a selling scheme on a bleeding basis.

Industry should, as far as possible, aid the working man to receive as much as possible out of the wages he works for, which is another way of increasing wages.

Mr. Wood saw in the fields and meadows bordering the "Lazy Shawsheen" an ideal setting for a modern and model town, and as a result of his vision Shawsheen Village today is the outstanding real estate development of the decade and one of the most unique as well as one of the most beautiful villages of the Commonwealth.

Starting with a crossroads town of a few houses which clustered about a small mill, the director of this enterprise planned to create a typical New England community, sufficient unto itself in business and recreation facilities and every other adjunct necessary for the comfort and happiness of its residents.

There was immediate need of houses, however, and once a general plan was adopted, construction of several was commenced on sites that would later fit into a harmonious scheme. But in the need for haste these early houses were not slighted in architectural detail but all were built along attractive colonial lines and are today, in fact, among the most pleasing in the whole community.

Great elms were a feature of the original village and one of the first steps in the general scheme was the moving of these great trees to selected locations, and so well was this done that they are today thriving in various corners and settings where they do much to remove the rawness usually associated with such development.

The old mill was torn down and the few houses around it moved some distance from the crossroads square, which was made the central feature of the new community. Along the Shawsheen River, a small, attractive, swift-running stream which was bordered by some marshy fields, rough field-stone walls were constructed, adding greatly to its charm while increasing its flowage, and the marshes then drained, filled and brought up to grade. When this preliminary work was finished an organization was perfected to carry on the project, a group of men, all employees of the corporation selected by the president, who caught from contact with him something of his ideals and his ability to accomplish things in the face of many obstacles.

In the spring of 1919 work was commenced in earnest and to hundreds of artisans and laborers Shawsheen Village was the one bright spot in a section seriously affected by the post-war depression of that year. Sewers, gas lines, telephone and electric light service wires disappeared underground by the mile, roads were staked, made and macadamized, houses sprang up almost over night, a trim cement-and-brick structure replaced the old mill, and a building to house the Post Office, the Shawsheen Market and several offices was started.

The organization that Mr. Wood had built functioned remarkably well. A woodworking plant was installed to get out interior finish, doors, blinds,



BANKER CONSULTING ENGINEER PRESIDENT PRODUCTION MANAGER

The Dividend — found — in the chimney

Banker: "Underwrite an issue of $500,000 preferred stock on the earnings you show? Never! And that's final."

President: "But our production manager can prove that the increased production will double the margin of safety on the preferred dividend. The new money makes it poss . . ."

Banker: "A banker is neither a speculator nor a promoter. Increased earnings, greater output, estimated sales, new business—everything is *dependent* on the new money. You don't seem to understand that you need larger net earnings by $35,000, or that amount saved in operating costs, to make this new capital issue sound."

At this moment the Production Manager entered accompanied by a famous Consulting Engineer. Everybody rose. "Here's the doctor!" began the Production Manager, "the chap who stayed up all last night looking for a serum to counteract high operating costs in this plant. And he found it."

Banker (scathingly): "And what is this wonderful serum, and just what has it got to do with this stock issue?"

Consulting Engineer: "The serum is just a little hot water and it has got everything to do with this stock issue. Isn't $40,000 saved equal to half a million increase in sales? The heat for the whole plant will be turned into net earnings—$40,000 a year. Grinnell Company engineers find the hot water heating system can be run from the waste heat from your enamelling ovens, thus doing away with three boilers."

President: "I can't believe there's any such waste. Our workmen have never complained of excessive temperatures."

Production Manager: "No, because the tremendous heat from those ovens has an ample vent through the chimney."

President: "I understand now. Why did we never think of that before?" (Turning to Banker) "Do you see what that means?"

Banker: "Yes, $40,000 a year saving is 8% on the preferred stock issue, but—"

President: "More than that: now that we don't need those three boilers for heating, we are free to dispose of the power plant altogether. We can buy electric power cheaper than we can generate it, as I told you."

Banker: "The power plant for sale! I'll bid $100,000 for it. You didn't know that the adjoining property was bought yesterday by the new forge works in which I am interested. Our plans call for a power plant and $100,000 would make a neat little capital reserve for your company."

President: "Sold!"

Banker: "$40,000 a year saving, cheaper power, $500,000 new money and interest on a $100,000 plant. Well, well, that ought to insure a common stock dividend next year."

President: "Say, gentlemen, do you realize the dividend which has been slipping up that chimney all these years?"

Consulting Engineer: "With the specialized engineering on hot water heating system that Grinnell Company furnishes, I'd almost guarantee to find the same sort of dividends in half the factory chimneys of the city."

Where the Facts Came From

Right now Grinnell Company is figuring with a large Chicago firm where harnessing the waste heat of their great enamelling furnaces will heat the whole plant. Practically, therefore, all their present heating expense is saved. Putting it another way, heating will cost them exactly nothing. Except for the financial matters mentioned in the ad the case is quite similar—a saving of $40,000 a year. The booklet, "Five Factors in Heating Cost," will be sent to anyone interested in heating industrial buildings. Send for your copy today. Address Grinnell Company, Inc., 307 W. Exchange Street, Providence, R. I.

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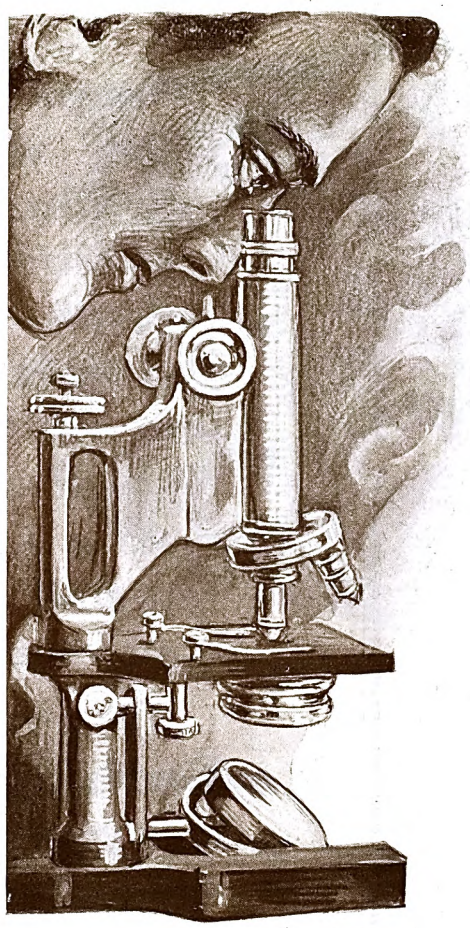
shes, etc., steam shovels simplified the roadmaking and the merous fills which were necessary and, thanks to the ganizing power, supplies of aterial moved into the village d were erected as if by clock ork.

And the same rate of progress s continued up to this writing. day we find at Shawsheen llage hundreds of houses of ick, wood, stucco and stone, attractive, livable and varied design, street after street ed with comfortable homes t in well kept lawns, a Village n with accommodations for rty guests and a dining room ating 200 persons, two gares, a laundry, a railroad staon, a beautiful drug store and a building, two office buildgs and a third being construct, a central heating plant for e public buildings, a huge athic field with a quarter mile nder track which is flooded in e winter, a swimming pool, nnis courts, a bowling green, dance pavilion, convenient ores where local tradesmen pply the wants of the commuty, even a community watering rt to flush the streets. The t is endless and space does not rmit an adequate description this remarkable community. But anyone driving through awsheen Village cannot fail appreciate its charm. It has t only been rapidly and effiently built but it has been autified as it developed. It is t new and raw, for it appears en in its unfinished state set- ed and substantial and permanent. Its business buildings are t too business-like to appear t of place in the country, the uses blend into the landscape, e great trees, the hospitable ats along the broad cement alks, the beauty of the occaonal vista, all are in keeping. Shawsheen Village is conted and prosperous, steadily owing and achieving, providg an ideal location both to emoyees of the American Woolen ompany and others desiring to ake this modern and model mmunity their home, and perps the most interesting fact that Mr. Wood's vision has aterialized successfully rather an meeting the fate of so any other Utopian dreams of mmunity development.

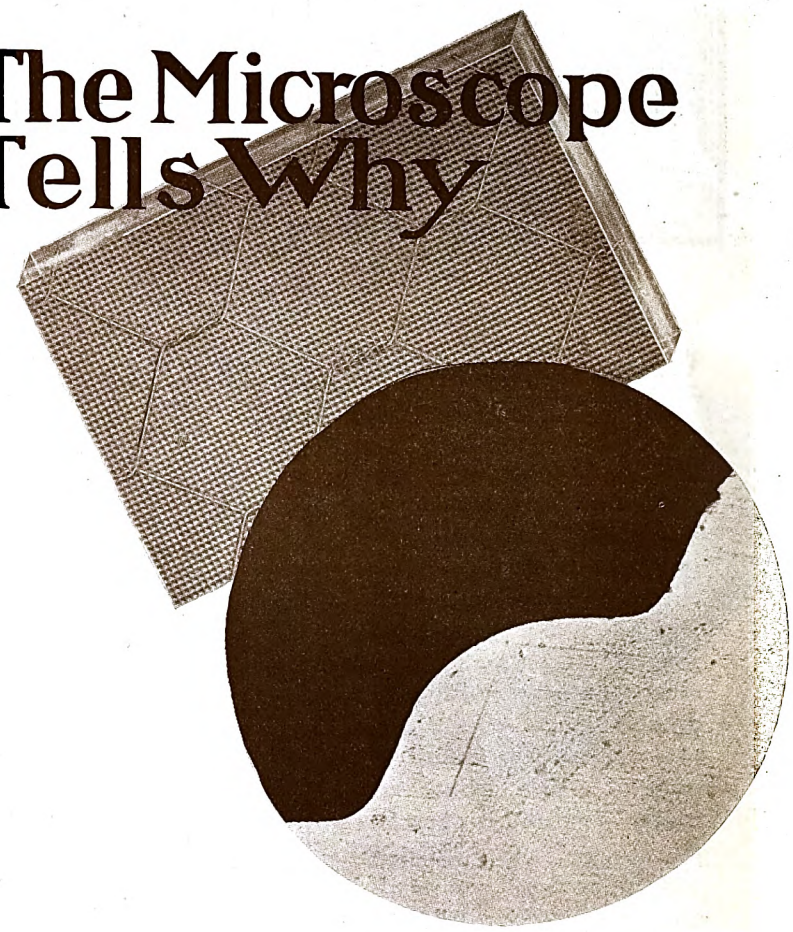
I made inquiries among the eople living in the community, well as among officials of the oolen Company, as to whether required any artificial stimulus or assistance from the company to interest the members of the community in civic and recreational activities. My answers were all alike and to the effect that the members of the community immediately and without any artificial stimulus whatever, voluntarily took up active participation in the proper organization and supervision of the educational, civic, and recreational activities.

Shawsheen Village is a successful accomplishment which may well be the model for thousands of other American communities which will replace the slovenly and disorganized hamlets which house the workers of many a great industry. It has been a success from every standpoint, including that of adequate financial return from the investment.

A representative of the Personnel Department of the Company says: "We first thought that the services of the department might be necessary in this connection, and in fact, laid an outline that we thought it would be wise to follow, but we found



The Microscope Tells Why



FACTROLITE

Diffuses Daylight

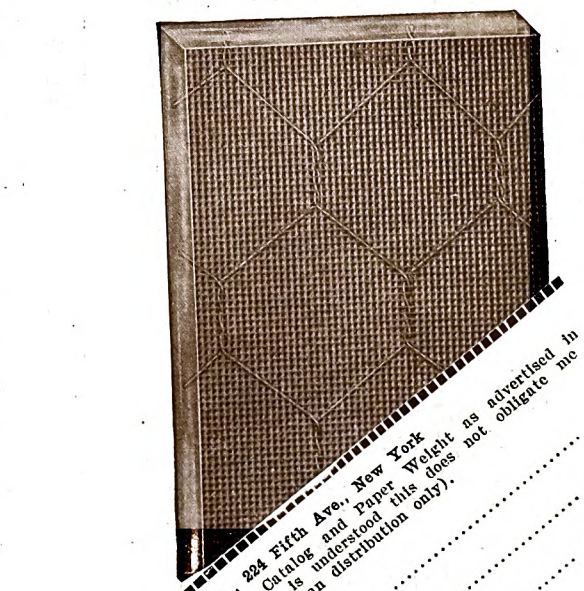
Each little pyramid has **plane** sides but a rounded apex, and a rounded fillet between rows.

FACTROLITE is scientifically designed to prevent direct reflection of daylight, even when the light strikes at a narrow angle of incidence to the panes.

At the same time the maximum degree of **diffusion** is attained. Large and small industrial plants have used thousands of feet of this improved daylighting glass.

At a time when conservation of resources is a paramount need, why not consider the conservation of daylight?

A sample of FACTROLITE sent on request to any engineer. Simply fill out and mail the attached coupon.



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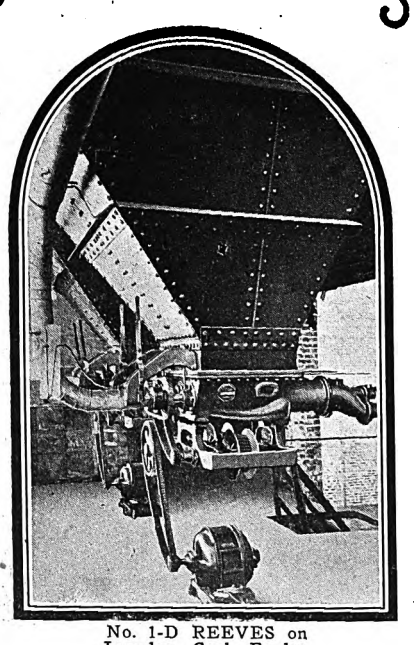
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SLOW speed, fast speed, or any speed in between, is made possible on any machine through The Reeves Variable Speed Transmission. This inexpensive, durable, efficient device gives you accurate and absolute control over a wide range of finely graduated speeds.

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"The Reeves" Variable Speed Transmission

Write for Catalog, T-44

REEVES PULLEY CO.
COLUMBUS, INDIANA

when the houses began to fill up that no direction or encouragement of any sort was necessary since there seemed to be a natural call and need for community organizations from the people living here and several that were formed some two years ago are in a very flourishing condition today."

The center of the community affairs is a body known as The Shawsheen Village Civic Association to which every resident of the village upon coming here automatically becomes a member, and their activities are handled through several committees. For instance, the Welfare Division acts as a sort of reception committee to new residents, makes them acquainted with all the families, and takes care of informing them of the facilities that the village offers. There is an Athletic Committee which manages tennis tournaments, field days, etc., among the residents. There is a committee that handles Boy Scout and Girl Scout matters, one for civic affairs and another that plans and carries out entertainments, and still another that interests itself in school affairs.

There has also been formed a Women's Club, which now numbers about 200 members; a Boys' Club and a separate Athletic Association for the encouragement of sports, which handles all competitions with outside teams; an organization which maintains and manages a bowling green; and numerous other small groups of people interested in one particular thing, such as music, radio, etc.

All these are the result not of the activity or suggestion of any personnel department, but came into being because the residents of the village felt a need for them.

The Post Office Department, or, in the final analysis, the taxpayer, pays an annual toll amounting, in round numbers, to $1,740,000 for the careless addressing of mail matter; the depositing of letters and packages with incomplete, inadequate or incorrect addresses, an overwhelming majority of which comes from large patrons of the mails.

In another effort to stem the tide of this waste. Postmaster General New has designated the week of February 18 to 25 as *Better Mailing Week.*

What can you do for *me*?

Your equipment is individual—your methods are individual—your needs are individual. And when you need conveyor belts you want conveyor belts that will do the best work on your installations. You want a scientific and intelligent study of your equipment needs.

That is precisely what Goodrich supplies. Goodrich conveyor belt recommendations are always governed by *individual* working conditions. A Goodrich engineer will study your installation and recommend the belt you need.

We will be pleased to have you consult us for a solution of your conveyor problems.

THE B. F. GOODRICH RUBBER CO.
Akron, Ohio

Goodrich
"LONGLIFE" Conveyor Belts
"Best in the Long Run"

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Patriarchal Versus Modern Shop Management

(*Continued from page* 17)

n the departments where training on the job" has been ctive.

When the Willys-Overland ompany of Toledo, Ohio, found ; necessary, due to increasing rders, to put on more help, and ncrease the number of em-loyees from 7,000 to 13,000 in hree months, it was obvious hat a large part of the 6,000 ew men would have to be uickly trained and inducted nto the various automotive ac-ivities of that large plant.

An expert training engineer vas secured and a small organi-ation formed, which knew how o train and rapidly develop men nd women to carry on the nu-nerous operations which go to nake up the automobile busi-ess. And "training on the job" vas started. Separate training ections were quickly planned nd installed, instructors se-ected, equipment and tools ound, and the work of "train-ng on the job" was under way. n a remarkably short space of ime twenty-five—fifty—then eventy-five of these training ections were planted through-ut the various shop depart-nents, and the training hives ommenced to turn out men and vomen thoroughly trained and rounded in the jobs they had tarted only a short time ago to earn.

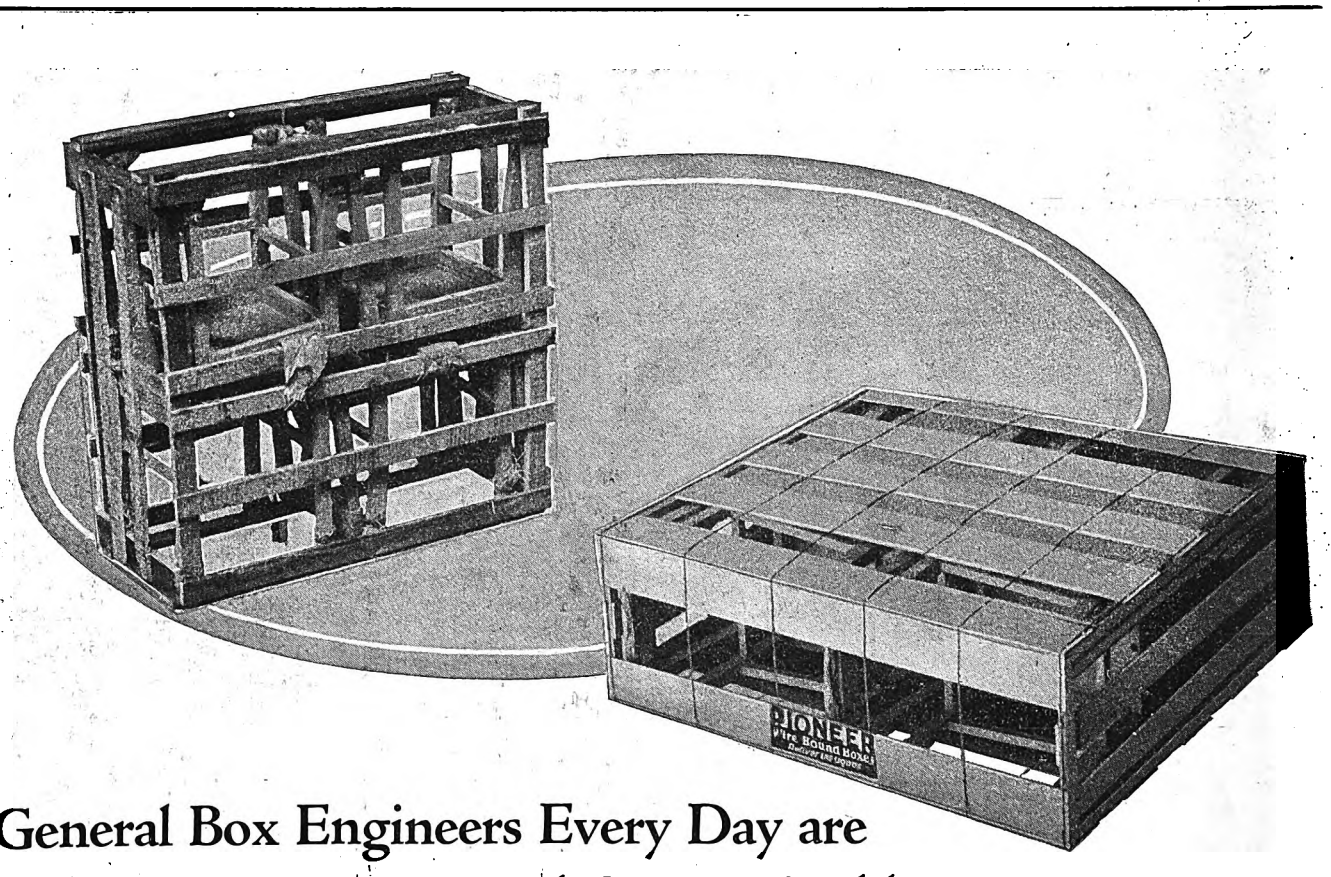
The progress made was amaz-ng. Superintendents and fore-nen who, previous to the instal-ation of these training sections nto their departments, had hought themselves "lost" on the abor problem, were soon put at ase when they discovered how uickly the training organiza-ion supplied them with a satis-actory type of men and women vho would at the outset produce s much and as well as the so-alled old hands.

This had a stimulating effect pon the old hands, as they learly saw that the newcomers vere rapidly becoming prepared o take bench or machine, in or-ler that production might go on ninterrupted, in event that hey should show a dissatisfac-ion or neglect to perform as hey ought.

At first, some may think this ot to be a good condition for he old workers; but if they will eflect a moment, it will become bvious that the average worker eeds stimulus of some sort brought to bear which will cause him to steady down and get the best out of his work, instead of roaming around, shopping for "greener grass" or better conditions, which very seldom exist.

When a real opportunity comes, a man will recognize it, and in all probability he will accept the promotion, but there is nothing gained for either the worker or the concern he is leaving, if his leaving makes one more "roamer" in the industrial world.

Manufacturers are now giving much thought to the importance of properly "fathering" the newcomers who are hired to learn; also the man who claims to be this or that, but upon his being put to the task, it is discovered by both the man and the boss, that he is woefully lacking in the experience necessary to the peculiar work in that particular shop, although he has



General Box Engineers Every Day are Solving New Boxing and Crating Problems

A furniture manufacturer became interested in General Box Engineering Service. He invited our co-operation.

Above is shown the crate he has been using and the Pioneer Wirebound Crate designed in our laboratory. Following is the story of the economies effected by the new crate.

Cuts Cost in Many Ways

The Pioneer Crate saves money in many ways. It is 15 pounds lighter—cutting transportation costs. It offers better protection to the chairs, reducing damage claims.

We deliver Pioneers three-fourths assembled—cutting the cost of building crates more than one-half. They can be packed more easily and closed in a fraction of the time previously required. Unpacking is simplified. Clip the wires with an ordinary wire cutter—a matter of seconds. The entire top opens up like the lid of a trunk. One chair can be lifted out, if desired, and the others remain in the crate until needed. Naturally this manufacturer's customers like to receive shipments in Pioneers because they simplify uncrating and storing—and deliver the goods undamaged.

This Service is Available to You

Every day General Box Engineers are developing better and more economical boxes and crates for shippers. It is possible they can help you. It will cost you nothing to find out. Merely write us that you would like to have a General Box Engineer call on you. He will do so as soon as possible.

A copy of "General Box Service" will be sent to anyone interested in the subject of better boxing and crating. Ask for it.

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worked on a similar job somewhere else.

Here is where, "Training On the Job's" well directed plan comes into importance, as it tests, trains, upgrades and adjusts all labor coming in or going out through its training sections; therefore very few who earnestly desire to work are lost to the plant.

When numerous sections of this form of training are installed in a manufacturing plant, they afford a wide field of fitness for the training of labor as we find it today, and unless men going into its fold are unreasonable, or have some hidden reason for squeezing out of the plant, they can be, and are taken care of and trained on some job for which they are suited, and which also is to their liking.

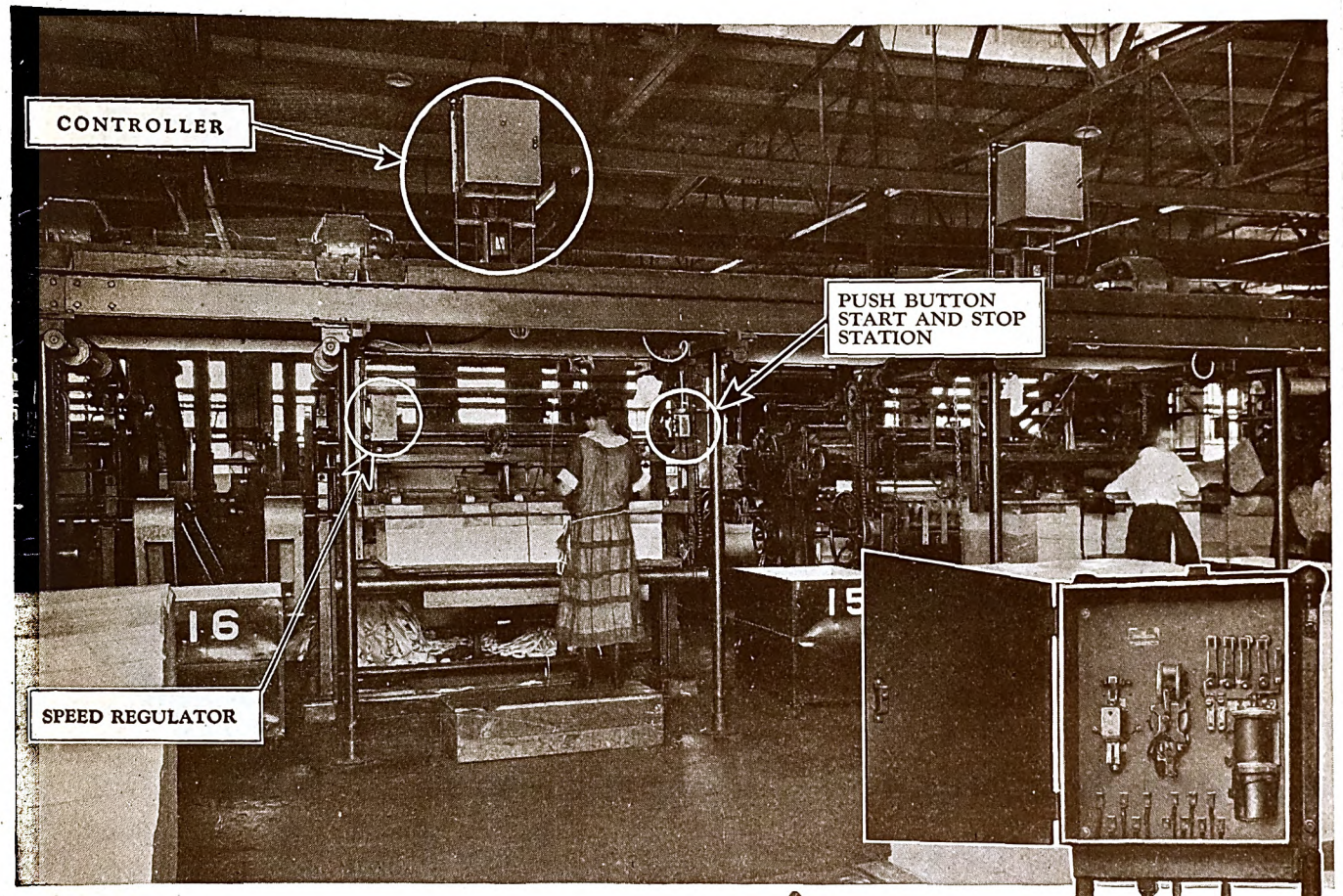
The money factor is by no means the only important one, as after all it does not vary enough in the general field of certain industries to make any material difference. However, the most important thing for us to learn today, is to educate the foremen to keep the help long enough so that they will get that "feel at home" spirit, then the battle is won and the money factor will be found to be only secondary.

During the war, emergency men were in such demand that but little encouragement was needed from their friends to animate them in gathering a few tools together in a hand-bag, and going forth into the industrial world to "break in" to some trade. This method was adopted, and encouraged, because of the great need for men at the time, as well as because of its being easy to get good jobs at high wages; which resulted in the letting down of the bars to anybody and everybody who sought a footing in a trade.

Today there are hundreds, if not thousands of these men that claim to be tradesmen, who are absolutely devoid of the elemental requirements of the craft in which they are working. They have never learned, nor have they had the opportunity to learn the A B C's of the trade they are trying to follow, and manufacturers everywhere are paying out good money for a return which is very questionable as to profit.

For instance, the number of *good* tool-makers is now pitifully small, and they are chiefly of the older generation. As they pass, there are almost none being trained to take their places, resulting in the new method of "Training On the Job" by the intentional method, rather than by the old method of "breaking them in." Thereby men and boys are inducted into our shops and plants and rapidly trained to operate some single-purpose machine or unit for manufacturing, and then supplementing this training by the study of the applied academic work, either by part time study in the shop or by going to one of the night schools set up in most of our large cities.

Moreover, the attitude of the worker toward his job has undergone a decided change, for he expresses it both by word of mouth and by his actions. He is in the shop to get all there is out of it. If good fortune or the current requirements put him in the position of being sought after, his first thought is of the opportunity this gives to "jack up" his wages; not how he can best serve the plant, or best develop himself for the new job. In place of coöperation there has developed a chip-on-the-shoulder

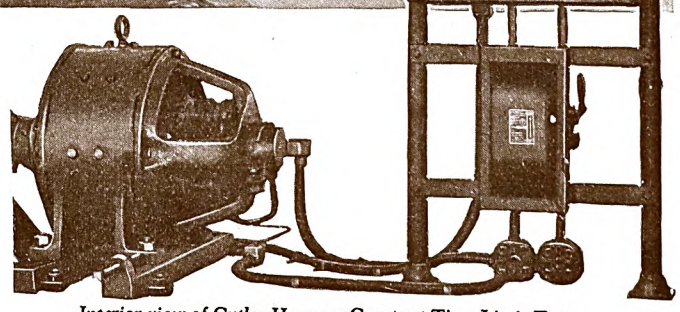


The Right Type of Acceleration Improved Cutter Production

By adopting control equipment designed by C-H engineers, with recommendations from the electrical engineer of the Champion Coated Paper Co., difficulties and delays in the cutter department of this paper mill have been eliminated.

Although individual cutter drive with automatic current limit acceleration used on 15 cutters was a big improvement over line shaft drive, there were a number of objections to current limit acceleration. For perfect control of paper cutting *time limit acceleration* offered the only solution. The smooth even start secured with this type of control permits quick acceleration to full speed of 300 feet per minute without breaking the lightest weight paper, and it eliminates the cutting of the first sheets under length as is the case when cutters are started with a jerk.

The enclosed C-H Automatic Controllers are installed on a gallery above the cutters. A Start and Stop Push Button Station is placed at a convenient point, with a speed regulating rheostat easily reached by the operator's left hand.



Interior view of Cutler-Hammer Constant Time Limit Type Automatic Control Panel—one of 20 used with motor-driven cutters in plant of Champion Coated Paper Co.

Each operator has complete control of starting, speed regulation, and stopping without leaving the platform. The motor always accelerates in a given time, and since the controller carries both Overload and No-Voltage Protection Devices, there is no liability of damage due to excessive current and interruption of the power supply.

The Cutler-Hammer line of motor controllers is the most extensive in the world. Ever since motors began to be used commercially, C-H engineers have been developing starting and controlling equipment. When you call in any C-H sales engineers you are getting the benefit of this long experience.

THE CUTLER-HAMMER MFG. CO.

Motor Control Department

Works: MILWAUKEE *and* NEW YORK

Offices and Agents in Principal Cities

Northern Electric Co., Ltd., Canada

C-H CUTLER-HAMMER **AUTOMATIC CONTROLLERS**

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spirit subversive of good results. There is a way out, and that way is through *education*. We ll need it. You and I are training constantly and we must continue to seek more light if we xpect to hope or keep up near he band in the industrial profession. Most superintendents nd foremen are taking up some orm of study for self-development, so that they may also keep n the industrial swim. Why hen, do we not recognize the act that the men entering or lready employed in our shops lso need to be trained?

"But the workers' attitude is ifferent from ours," said a superintendent to me the other day. We men of more experience now that we have to keep ourselves in training, and also that he workers need to be trained; ut the workers do not know hat they need to be trained; urthermore through lack of efficiency, they claim that the job is o good and that we are trying o keep them down and in ignorance of how our business is un, when as a matter of fact ve want them to get a full knowledge of all our shop methods and processes, that they may become better workmen and more valuable to themselves and he company as time goes on. But somehow we do not get this across to the men, resulting in a serious industrial condition; hat of not having more than ifty per cent. of our help 'hitting the ball.' "

As an example of the value of training service, when the Willys-Overland Co. needed additional help in their press shops, they had to resort to advertising for this new labor; the advertisement read as follows, 'Helpers for Press Work." The psychology of that "ad." told the men they were wanted on laboring work and showed them no advancement.

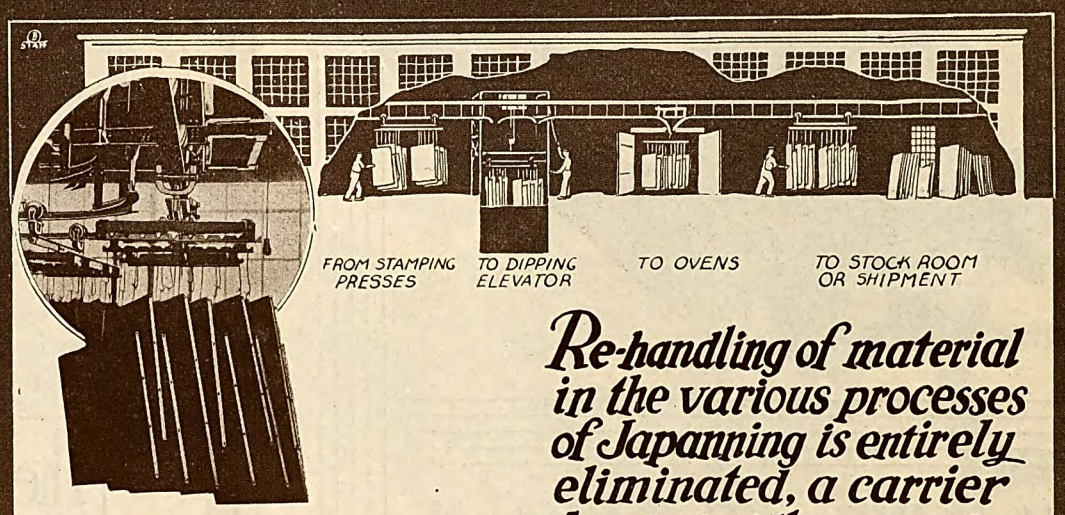
The Training Engineer's attention was called to the results from the advertisement, and found that no men came in, in response to the ad. He suggested that the phraseology be changed to, Assistant Press Operators. The next morning a sufficient number of men came for the job, for this really did suggest exactly what the job was, as the presses for automobile work are very large and it calls for two and sometimes three men to operate them.

When the new men started training on the job, they were told that when they demonstrated that they were competent assistants, they would be promoted and re-trained as first string operators with an increase in wage. You see, what was needed most in this shop at the time were good first-class press operators and the assistant job was only a stepping-stone to the real job for which men were very badly needed.

A common error among some of our foremen is that the machine does all the work. Now, however true this may appear, it is erroneous; for the machine without an operative who can get every last ounce of work out of it each hour, is an unprofitable machine unit for both the employee and the employer.

We give lots of thought to the proper selection of the machinery used in the plant, and if perchance it is not performing as it should we immediately get an expert on the job. If the materials or tools do not come up to the mark, we hop right into the trouble, and we keep experts on tap ready to go when called. But the labor—it is usually

(*Continued on page 69*)



Is This Economy?

One sheet metal product manufacturer —using the Cleveland Tramrail—is saving $30,000 each year in labor costs alone —on an investment of less than half that amount.

Besides, he is saving a great amount of floor space, using only one-half as many baking ovens as before, saving expensive heat, and speeding up each operation.

Re-handling of material in the various processes of Japanning is entirely eliminated, a carrier loaded at the stamping presses need not be re-handled until it is unloaded at the finished stock racks.

It is only possible by means of the Cleveland Tramrail.

CLEVELAND TRAMRAIL SYSTEM

HAND-OR-ELECTRIC

Our Engineers are at your service. Use them.

It can be adapted to your particular industry.

Carriers will be devised to handle your particular product.

Let's get together and figure a method for greatly reducing your material handling costs.

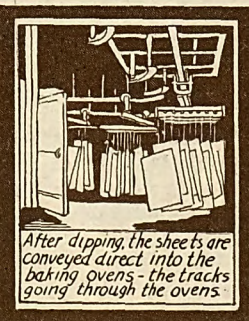
CLEVELAND ELECTRIC TRAMRAIL
A DIVISION OF
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE, OHIO

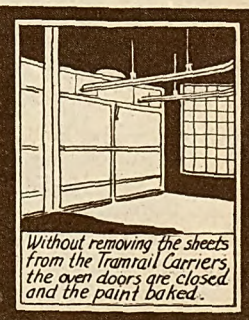
SALES OFFICE.

50 *Church Street, New York City*
2401 *Chestnut Street, Philadelphia, Pa.*
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149 *E. Larned Street, Detroit, Mich.*
511 *Farmers Bank Bldg., Pittsburgh, Pa.*
500 *Arch Street, Pittsburgh, Pa.*
1309 *Pine Street, St. Louis, Mo.*


Large carriers transported on the Cleveland Tramrail gather the sheet metal parts from the stamping presses


A paint dipping elevator part of the Cleveland Tramrail System - Submerges the sheets in the vat.


After dipping, the sheets are conveyed direct into the baking ovens - the tracks going through the ovens.


Without removing the sheets from the Tramrail Carriers, the oven doors are closed and the paint baked.

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NATIONAL ROCKER-LIFT ELEVATING TRUCKS

Like Play To Lift A Ton Load On The ROCKER-LIFT TRUCK!

THE new National Rocker-Lift Elevating Truck raises a ton or more load off the floor so quickly and easily that even a lazy operator has no time to remember that he is working.

Moreover, the operator who braces himself to exert the savage jerk and back breaking strain on the handle that is usually necessary to elevate a ton load on older fashioned lift trucks is destined to feel like the man who reaches up in the dark for the step that does not exist. Nor does he have to make a jack-knife of himself and swoop the handle all the way to the floor—the handle has completed its lift when the end is knee high.

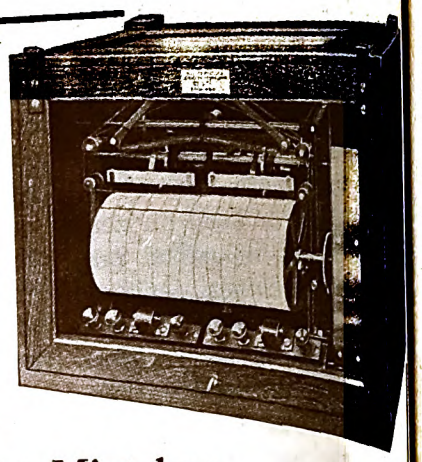
Another decided advantage of the Rocker-Lift Truck is the fact that it may be elevated when the handle is at any desired point between directly front and a full right angle on either side. Think what this means in convenience and speed when narrow aisle work is necessary!

This truck is also built of tested materials and according to designs that our many years of shop-truck manufacturing have shown are best and serviceable under all working conditions. We would like to send you complete information concerning models suitable for your requirements.

NATIONAL SCALE CORPORATION
3 BRIDGESIDE AVE. CHICOPEE FALLS, MASS.

Manufacturers

National Counting and Weighing Machines, National Calling System, National "Adjustable" Steel Shelving and National Elevating and Scale-Elevating Trucks.



CAMBRIDGE ELECTRICAL CO_2 RECORDERS and INDICATORS

Will save you Time and Reduce Mistakes

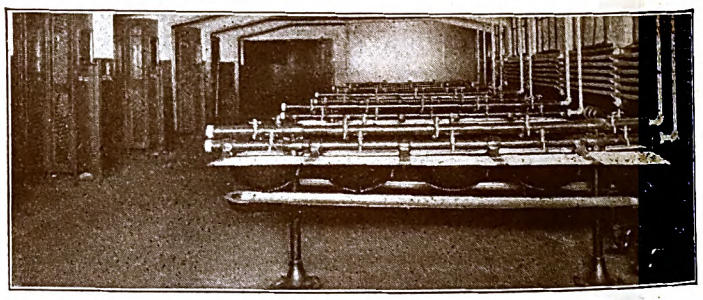
Cambridge Co. Instruments are a cost cutting proposition for any boiler room fully meeting every requirement for accuracy and rapidity of action.

Four Readings On One Chart

Mean a continuous comparative check on four independent units at the same time with less possibility of error in readings. They are entirely electrical—no chemicals to renew—no glass or rubber parts to break or wear out. They can be installed any distance from the flue and still be as accurate as an Orsat.

Made in several arrangements to meet a wide range of requirements. Write for list No. 157-A.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC)
MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY



MEECO INDIVIDUAL SANITARY WASHBOWLS

Were designed especially for factories to provide a sanitary, efficient washing-up apparatus at a moderate cost. They have displaced the open sink, the common trough and other unsanitary methods of washing-up and have been pronounced by many authorities the ideal factory washbowl, whether the plant employs 50 or 5,000 men. They are ruggedly built, simple in construction, easy to install and eliminate high plumbing expense. They are space-savers and take up no more room than common sinks.

A few of the prominent firms who are large users of MEECO Individual Sanitary Washbowls:—Amoskeag Mfg. Co., 1000; Bethlehem Shipbuilding Co. (Fore River Works), 1000; Central of Georgia R. R., 1000; Colt's Patent Fire Arms Mfg. Co., 3200; General Fire Extinguisher Co., 1200; New Departure Mfg. Co., 1600; Pratt & Whitney Co., 2800; Underwood Typewriter Co., 1000; United Shoe Machinery Co., 2400. The complete list of firms using MEECO Washbowls reads like the Blue Book of American business. 5000 companies in 200 lines of business have adopted them as washroom equipment.

They Are Really Sanitary

There is room enough at each bowl for every man to get a thorough, clean wash without crowding. The unsanitary and inefficient features of washing in a running stream are here obviated. There is no slopping over on other men. There are no half-way attempts to get clean. There is no waste of water. Let your men put the plug in, fill the bowl and clean off the grease and grime. They can't do it in a running stream.

Send Today for Catalogue and Price List

Shelving *Chairs and Stools* METAL MEECO PRODUCTS *Lockers* *Drinking Fountains*

MFG. EQUIPMENT & ENGINEERING CO.
FRAMINGHAM, MASS.

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(Continued from page 67)

left to shift for itself, with no "daddy" to help or advise. I have seen the production, on an ordinary punch press, jump from 22,000 to 30,000 pieces in nine hours, where training of the help was given proper study and attention.

Fortunately, today, a large number of manufacturing plants in this country are now giving careful thought to the training of their help.

In most cases the newcomer is put into training in a section nearby the regular production work. There is a distinct advantage gained by having the trainees in the proper environment, as the atmosphere of the regular shop tends to cause the stranger to feel that he is to become part of a great manufacturing plant, just as soon as he can demonstrate his ability for the part he is being trained to take; but all trace of fear and uncertainty is banished by the fact that he is placed in a separate section and under the guidance of an instructor who is going to father him until he is able to get along without assistance. This causes the trainee to lose all nervousness and fear of the job, and his progress is thereupon much more rapid.

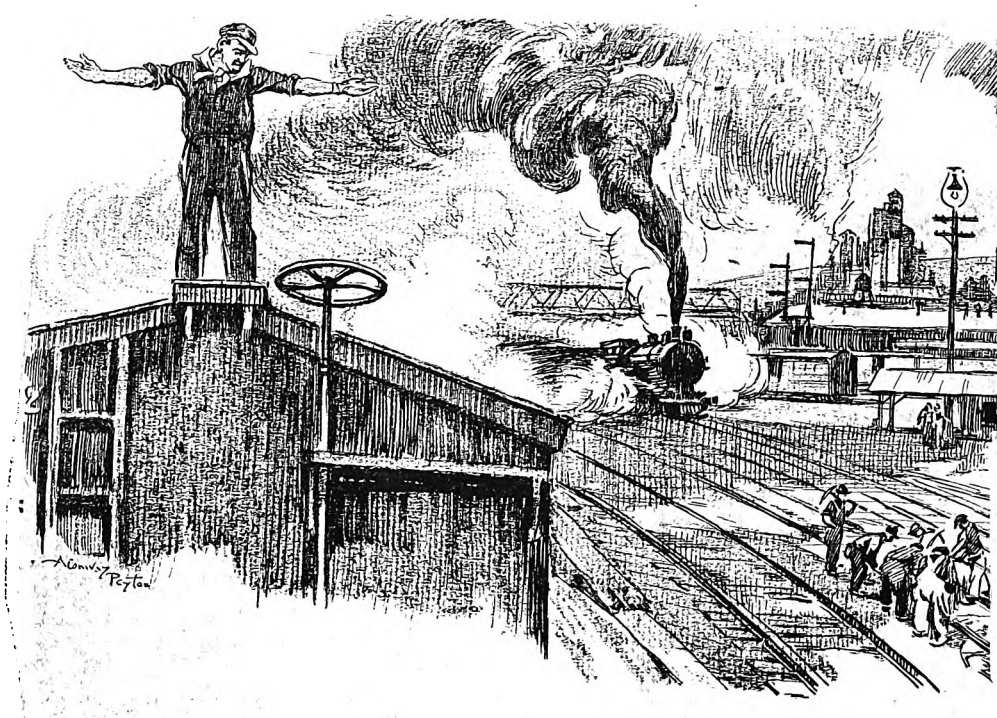
Occasionally a training section has to be "centralized" as was the case at Willys-Overland, where metal machine tools were scattered all about the plant in order to facilitate a more rapid handling of the production work. When this condition is found to exist, a few units of machine tools can be brought together in some central part of the plant and the production work brought to it for training use, then the men are trained here on the same machine and job, and when up to production and able to make piece work, promoted to the plant department.

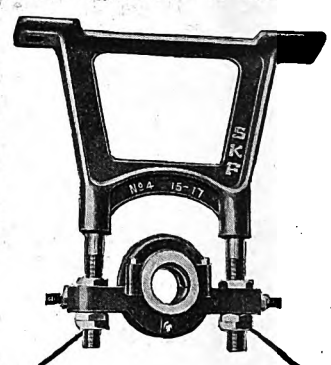
In the radiator department, where the operations numbered into the hundreds, a segregated training section is set up adjacent to the main shops. Here the instructor receives his new help and either trains them in the section or out on the floor, when it is necessary to do so due to the lesser need for men on that particular work, or because the equipment is too unwieldy to move into the training section. At all times the training instructor is in charge of the new men and right on the job to see that they learn well and complete training in the shortest possible time, and without waste of time, material or tools.

At the Winchester Repeating Arms Co., a unique training situation arose, when it became necessary to train and develop in an intensive manner a number of young men to become electrical wiremen.

Ordinarily it takes something like three years to train these mechanics. The Winchester problem, however, was to teach men to do the necessary wiring of unused war buildings, making them ready for shops where a line of new products were to be manufactured. Of course, these men had to be taught so that proper installation of this electrical equipment would go on without undue waste of time. However, it was not necessary to teach them all of the trade as it is universally practiced.

We set up a "training laboratory room," where the young men were received and taught Materials — Electrical Equipment — Construction—Installation — Operation — and Inspection of the electrical equipment thus installed. Academic





Brakes—Friction—Bearings

WHEN the brakeman of a fast moving train signals for the brakes to be applied, the train's motion is retarded by a sliding, dragging area of metal—friction.

When the shafting of your factory turns in babbitt bearings with their long area of metal, each bearing acts like a brake wasting in friction, heat and wear much of the power that should be available for useful work.

Just as a locomotive cannot pull against set brakes—neither can your shafting operate efficiently when its motion is retarded by friction's binding grip.

Let our engineers estimate on an installation for your plant and point out some of the savings that the 9000 users have made by removing the brakes from their line shafting. Skayef Self-Aligning Ball Bearing Hangers always pay for themselves in two years or less.

For Nearest Distributor, See MacRae's Blue Book

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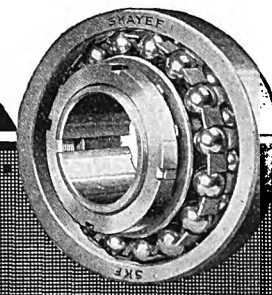
SKAYEF
—the 4-Saving Hanger

1st Saving Skayef Hangers save from 50 per cent upward of the energy which plain bearings consume in friction. This means a saving of 15 to 35 per cent of your power cost.

2nd Saving Considerable time is saved by eliminating shutdowns for replacing or adjusting bearings; forced idleness of machines and men is a cost-factor too big to be ignored.

3rd Saving Lubricant consumption reduced 60 to 80 per cent as compared with plain bearing hangers. Lubricant required only at infrequent intervals and it cannot leak out and ruin belts or product.

4th Saving There is no discernible wear of the hard steel balls and races and absolutely no shaft wear. Dust and grit cannot enter the bearings and Skayef self-aligning ball-bearings have the exclusive inherent ability of compensating automatically for shaft deflections.



SKAYEF
Self-Aligning Ball-Bearing
HANGERS

Made Under **SKF** *Supervision*

THE SKAYEF BALL BEARING COMPANY - - - - 165 Broadway, New York City

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instruction necessary was given in the company's school.

After the men had learned the laboratory work (which took about two weeks) they were assigned to a construction job, usually three men to a job. The Instructor always went out with the men to instruct them how to lay out the work, showing them the right way to do the job, and the things to watch in order to avoid errors. He would then leave the first group and go on to the next, etc. In about four weeks these units were able to go ahead unassisted, lay out their own work and complete the job, the Instructor acting only as an inspector of their work. Thirty men were trained in this manner and the company was able to start the new shops as rapidly as needed for the seasonable products they were introducing.

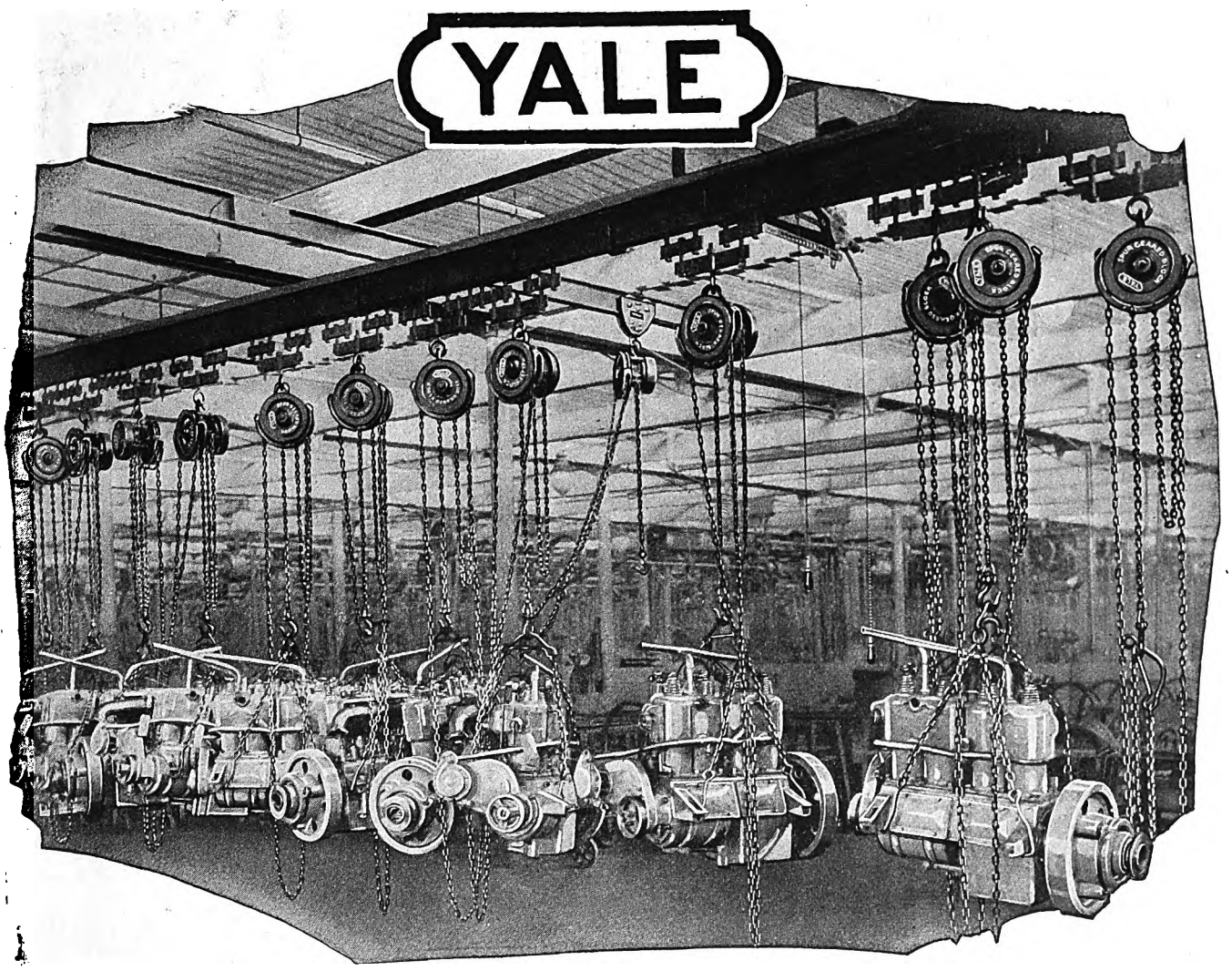
When these New Products shops were installed the Training Engineer started to set up training sections for the training of labor for these new shops. Some fifty different training sections were thus set up and the labor prepared for the different shops.

It was sometimes necessary to give the Training Engineer full charge of the new shop so that he could act as a mentor to the nominal foremen, sub-foremen, tool-setters, planning, scheduling, and production supervisors. In other words the whole shop was, for the time, in training, and when the shop was running well and everything orderly and the production up to schedule, the Training Engineer retired from that particular shop. But his training organization continued to train the labor necessary to keep down the normal turn-over.

Plant managers who have investigated "Training On the Job" have found this method profitable; have found that increased production problems have disappeared when they have installed a well-conducted training plan in their plants, where not only the "green help" but a good number of the men already in the shops can be taken into training and developed into profitable factors, both for themselves and the company.

James J. Davis, Secretary of Labor, says in "TRAINED MEN," "First comes the human element as our best promise of continued prosperity and human expansion, if that human element is trained and fitted to meet the peculiar problems which face the American manufacturers today. In the past we turned our attention to our machines, today we must think in larger terms of the human element which towers above those machines. We must have trained workers, trained executives. Of course no man can learn by himself. None by taking thought can acquire knowledge. *He must be taught and a scientific job must be made of the teaching.* Especially is this true with the workman whose earlier training may have been limited. The human element comes first and I want the employers in industry to understand the aspirations, the convictions, the yearnings of the millions of American wage earners. And I want the wage earners to understand the problems, the anxieties, the obligations of Management and Capital."

The above is good counsel and advice, but the rank and file seldom find them in Industry today do not learn these truths, and more often there is no method set up to teach them.



Here's the answer to the labor shortage

YALE Spur-Geared Chain Blocks and I-Beam Trolleys are always ready for the specialized job of lifting and moving heavy machinery.

Keep your men at work, productively. You are paying twice as much for labor as you did twenty years ago, and even at that it is hard to get.

The illustration above shows how one well-known manufacturer of motor cars has solved the problem of this labor shortage—and you no doubt have a problem that can be solved in very much the same way.

Whenever a motor goes off the assembly floor in this plant it is carried on a Yale Spur-Geared Chain Block and I-Beam Trolley. This represents a big saving.

Yale Spur-Geared Blocks can always be trusted to carry costly machinery with safety and dispatch. Yale Blocks and Trolleys are individually tested to 50 per cent overload and every vital part, from hook to hook a line of steel, is made strong enough to stand the strain of emergency loads greatly in excess of the rated capacity.

YALE
Chain Blocks, Electric Hoists } For Lifts
I-Beam Trolleys, Industrial Trucks } For Shifts

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Makers of Yale Products
Locks, Door Closers and Material Handling Equipment
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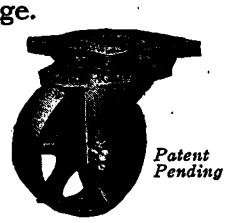
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Judge This Truck by Its Service



No. 15

The Zering No. 15 is used in practically every industry. It has shown tremendous ability to stand up under hard usage.



Patent Pending

Champion Adjustable Double Race Casters

These casters are used upon all Zering ball bearing platforms and trucks. They outlast the truck; give perfect service and can be adjusted by the turn of a nut without removing them from the truck.

Zering Perfection Platform Truck

This truck is also fitted with Champion Plate Casters. By reason of this, bolster breakage is avoided, a common fault with trucks having side bolt caster. Rails tenoned and grooved and bolted to side rails. Heavier loads can be handled with less effort.

Made in all sizes.

Write for catalog and full information.

The H. Zering Manufacturing Company
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Manufacturers of trucks, trailers, casters and skids



At Your Service

INVENTORS and builders of small-motor driven tools and machines—confronted with perplexing power problems—are invited to take advantage of the services of our Engineering Department.

This department has for many years been in close contact with the uses and application of small motors. Their experience is offered to you as a help in the working out of your own problems.

We will gladly co-operate with you in the building of a *better* product. Do not hesitate to call on us for advice. Our combined efforts will, perhaps, result in another appliance being made more saleable and more dependable because it is equipped with a motor that is exactly adapted to its particular job.

Wisconsin Electric Company
7068 Sixteenth St., Racine, Wis.



Type-A—Stripped
$\frac{1}{25}$ h. p. Cast iron frame, enamel finish. Babbitt bearings, wick oil feed, Operates on A.C. & D.C.



Type-D
1/8 h.p. Cast iron frame. Enamel finish. Plain bearings. Grease cups. Operates on A.C. & D.C



No. 3GM—Stripped
1/4 h.p. Aluminum frame, enamel finish. Normal bearings. Ventilated. Operates on A.C. & D.C.



Type-SAX
Motor 1/25 h. p. Special base.

DUMORE

FRACTIONAL H.P. MOTORS





Tycos Temperature Instruments

INDICATING - RECORDING - CONTROLLING

Are the kind that the discriminating manufacturer buys. The reason being all round satisfaction and dependable operation.

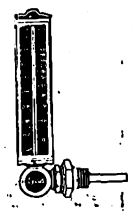
Mention your products. Literature and data that is of direct assistance to your production will be sent.

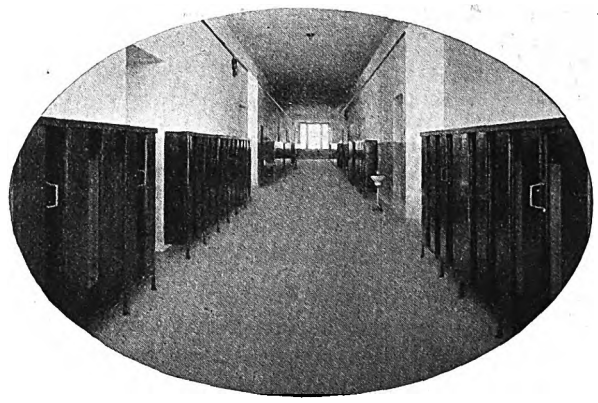
Taylor Instrument Companies

Rochester, N. Y., U. S. A.

Canadian Plant: *Tycos* Bldg., 110 Church St., Toronto

There's a *Tycos* or *Taylor* Temperature Instrument for every purpose





A GOOD FLOORING

There are many reasons why Marbleloid *Permanent* Flooring is used extensively in Industrial buildings for Offices, Laboratories, Hospitals, Cafeterias, Welfare Rooms, Workrooms, Toilets, etc.

It is fireproof, resilient, non-abrasive, non-slipping. Does not require expensive upkeep and can be laid upon old or new wood or concrete floors. It is a standardized lightweight composition flooring, manufactured, installed and guaranteed without restriction by us. Laid plastic, it sets in a few hours into a seamless, smooth surfaced floor, good for a life-time of service.

The Coupon below will bring you the detailed advantages and cost of installing Marbleloid Floors in your new building or for resurfacing your old floor.

MARBLELOID
The Universal FLOORING for Modern Buildings

THE MARBLELOID COMPANY, 467 Eighth Avenue, New York

THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building.....; below are the approximate areas involved.
Floor.....Sq. Ft. Sanitary Base.....
Lineal Ft. Wainscot.....Sq. Ft. I have checked the floor troubles we now have.

Our floors are
☐ New Concrete ☐ Cement Finish ☐ Wood
☐ Cracking ☐ Cold ☐ Slippery
☐ Dusting ☐ Splintering ☐ Unsanitary
☐ Noisy ☐ Rough ☐ Rotting
Name .....
Firm .....
Address .....
☐ Please send 32-page illustrated Booklet.

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Modern Bearings and Their Lubrication Problems

(*Continued from page 25*)

the bearings of any machine or piece of equipment are those parts which carry or guide the necessary revolving, sliding, rolling or reciprocating mechanisms. Thus, it is evident that bearings are a factor wherever mechanical motion exists.

According to the type and function of the machine or piece of equipment the movable parts are usually termed journals, shafts, pins, rods, shoes or spindles.

Bearing surfaces are classified according to the manner in which the load is carried. Thus, where the line of application of the load is at right angles to the bearing, the latter is known as a shaft, journal or guide bearing. In contrast, where the load is exerted parallel to the axis of the bearing, the latter is commonly termed a step or thrust bearing.

Shaft and journal bearings are best considered together, on account of their similarity. In general they consist of cast iron or brass bearing pieces which are mounted in the bearing blocks, and surfaced with Babbitt metal or some other so-called anti-friction compound which has a relatively low melting point than the shaft or journal. Thus, this surface bearing metal serves as a protection for the bearing pieces, especially where they are of brass both by virtue of its lower melting point and the comparative ease with which it can be renewed in event of its becoming overheated to a sufficient extent to cause "burning out," or being scored or worn by the presence of foreign matter in the lubricant.

Guide bearings are somewhat similar in principle to shaft and journal bearings, and require surfacing or babbitting in the same manner to protect both the bearing pieces and slides. Bearings of this type, however, are generally flat or slightly concave, and are fitted on one or both sides of the moving part in order to preserve its alignment during operation. Reciprocating motion is usually customary in guide bearings involving sliding friction. The crosshead slide in a reciprocating engine and the lathe bedplate are familiar examples.

Step and thrust bearings are used where it is necessary to take up pressure along the axis of a rotating shaft or journal. They may be built either horizontally or vertically, depending upon the type of machine they are designed to serve. Horizontal thrust bearings in general will only be required to take up end thrust, or, in other words, the pressure of operation. Vertical step and thrust bearings, on the other hand, must be capable of both serving this purpose and, as well, of carrying the weight of the revolving parts as is the case in the vertical hydraulic turbine.

If we are to be able to judge whether a lubricant will adequately serve its intended purpose and give a lubricating film of suitable thickness in any bearing, the various types of bearings in common industrial use and their principles of construction, must be understood. It has already been noted that bearings can be broadly classified into two groups according



These four 600 H. P. oil-fired Edge Moor Boilers are helping American Agricultural Chemical Co. to keep power costs at the lowest level in their plant at Pierce, Fla.

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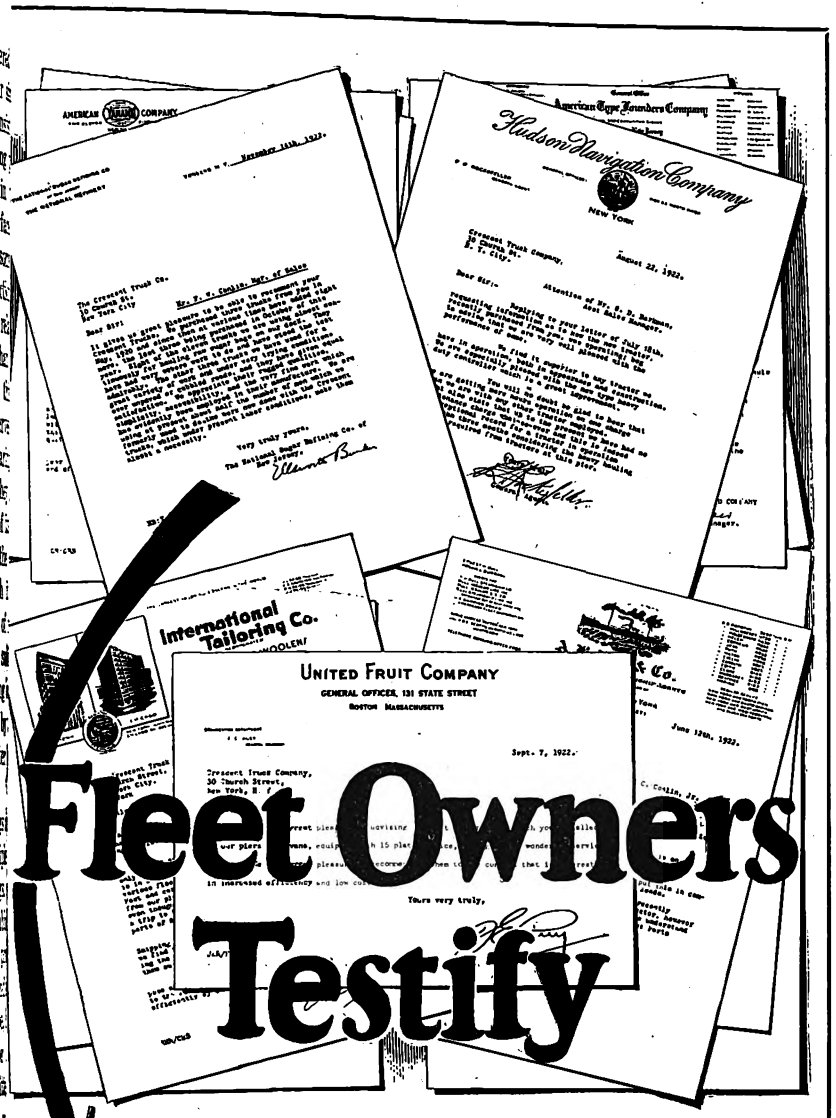
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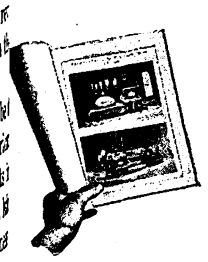
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"Have given us wonderful Service."
"Superior to any tractor we have."
"Savings has been quite considerable."
"This truck saves us $150.00 monthly."

These are only a few of the many letters we have received from users of Crescent Electric Trucks and Tractors. They come from representative firms in dozens of industries; firms whose operating efficiency is well known; firms who demand equipment that stands up under the hardest service.

The supreme quality of Crescent trucks and tractors is their ability to stand the constant hard wear to which they are subjected. Nothing goes in a Crescent that is liable to "go out" at an inopportune time; from the steel, hot riveted frame, to the specially designed General Electric motor, Crescent parts are as wear-proof as human brains and material brain can make them.



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Send for our booklet, it contains 48 pages of cost reducing facts.

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the manner in which their load may be applied. These classifications can be further subdivided in accordance with design and construction, *i. e.:*

(1)—*Shaft Journal or Guide Bearings.*
- a. Solid bearings.
- b. Solid bearings with bushings.
- c. Two-piece bearings.
- d. Four-piece bearings.
- e. Guide bearings.
- f. Ball bearings.
- g. Roller bearings.

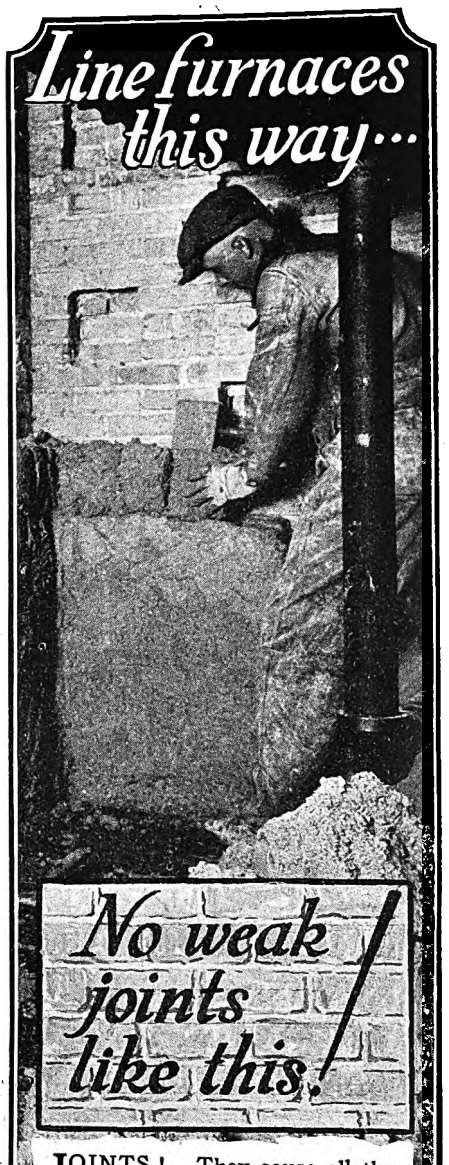
(2)—*Step or Thrust Bearings.*
- a. Plain sliding bearings.
- b. Ball thrust bearings.
- c. Roller thrust bearings.
- d. Horse-shoe thrust bearings.

Solid bearings constructed with or without bushings or sleeves are built in one piece. The shaft or journal can, therefore, be inserted or removed in an endways direction only, by sliding it in or out; as a result it is not possible to make any adjustment to compensate for wear, as it is in a two-piece or four-piece bearing. Solid bearings, however, with all this objection are advantageous in that they are relatively inexpensive, and can be applied equally well to horizontal or vertical service. They are in general used where low pressures, slow speeds and light wear occur. Horizontal bearings of this type are used where loose pulleys are involved, or for miscellaneous smaller shafting on cranes and hoists, etc., and as wrist pin bearings in steam and gas engine installations. In vertical installations solid bearings include the supporting or guide bearings for textile spindles, and the footstep shaft bearings in certain other machinery.

When wear is liable to be abnormal, solid bearings fitted with bushings are often substituted. Thus, as wear occurs, it is a comparatively easy matter to slip the shaft out from the bearing, whenever necessary, renew the sleeve or bushing, and be ready for efficient operation once again with little waste of time.

Two-piece bearings, or bearings which consist of two parts such as a bearing block and cap, are extensively used in the modern industrial plant for general shaft and journal purposes where solid bearings would not be applicable. Frequent examples of such bearings may be noted on line shaft hangers, and

(*Continued on page* 75)



JOINTS! They cause all the trouble in fire brick linings. They're the weak links that give 'way under the heat of the furnace and that make the need for entire relining certain.

Eliminate them. Install jointless Plibrico Furnace Lining, the way the man pictured above is doing. Pounded in while plastic with a mallet, Plibrico forms a one-piece, rock-like lining when heat is applied. It lasts two to four times as long as fire brick. It cuts heat loss through the setting. It can be installed by unskilled labor. It resists temperatures to 3100 deg. F.

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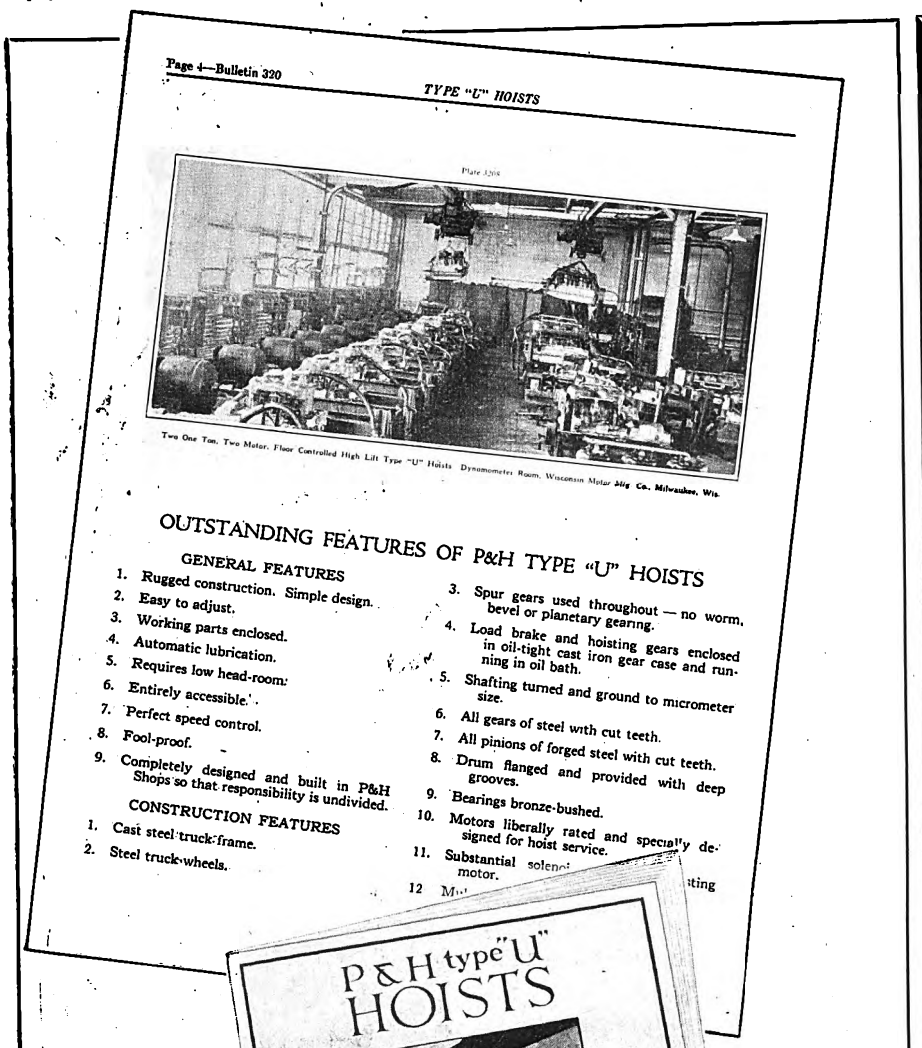
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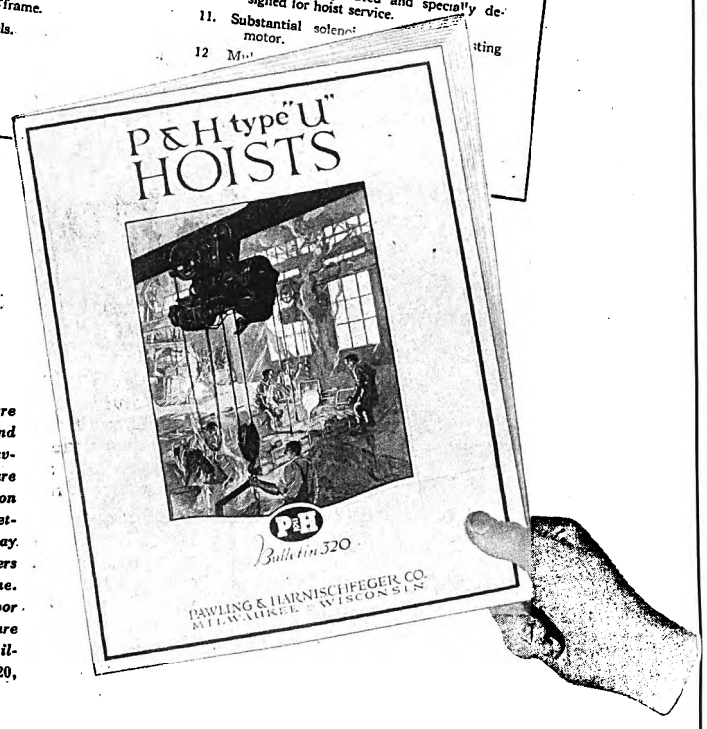
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New Bulletin 320

P & H Hoists are built as efficient and rugged as P & H Traveling Cranes — and are often used in connection with the latter for getting into out-of-the-way extensions and corners not served by the crane. The various types—floor and cage controlled—are fully described and illustrated in Bulletin 320, just off the press.

Quick Routing of Materials With P & H Hoists

Eliminating hard, slow manual handling of materials is one of the functions of P & H "U" Type Hoists.

They speed up this work, permitting smoother production and keep floor space and aisles unobstructed.

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Pawling & Harnischfeger Co.

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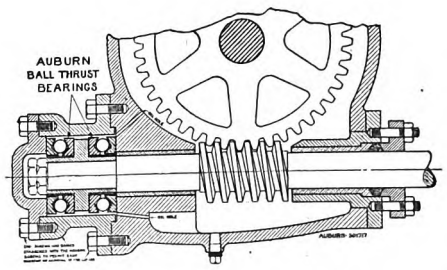
Please mail copy of your new Bulletin 320 on P & H Hoists to

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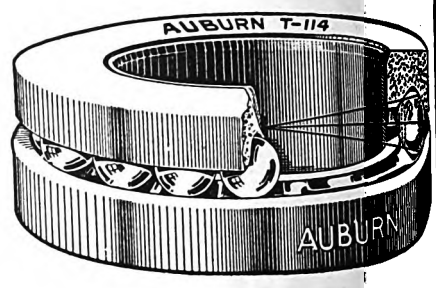
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If you wish bearings you can forget once they are installed, send us particulars of your problem and ask for circulars.

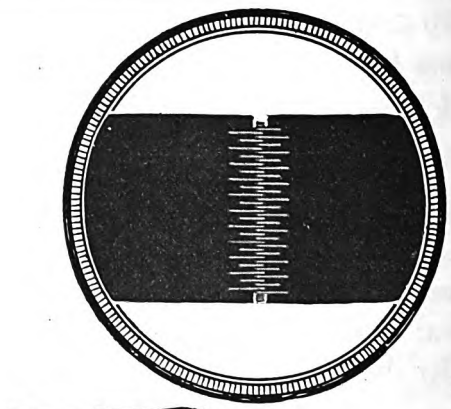


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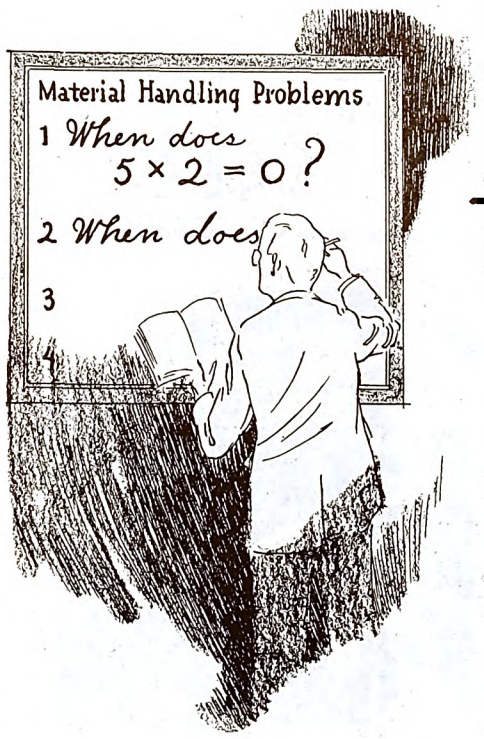
(*Continued from page 73*)

or engine crank pins and connecting rods, etc. In general, uch bearings are suitable and ost comomonly used where the haft pressure is directed either gainst the top or bottom brass. n line shafting this will be the sual condition. Certain conditons may, however, cause this ressure to be directed towards ne junction of the top and botom bearing pieces, in which vent it is usually advisable to ubstitute a so-called four-piece earing. The direction of pressre against any bearing junction will often have a tendency pound the bearing out-of-ound, or press the bearing etal into the chamfered edges. Four-piece bearings, therefore, are effective in such cases. our-piece bearings consist of our brasses, each one being independently lined with suitable earing metal, and securely held n the bearing block or cap. ach piece of a four-piece bearng is usually furnished with adsting screws and wedges for s adjustment in case of wear. hus, any individual bearing iece can be located properly ith respect to the shaft, and a uitable operating clearance can e constantly maintained. Fouriece bearings are generally sed as main bearings of larger orizontal steam and internal ombustion engines.

Guide bearings are chiefly sed on reciprocating steam enines, steam pumps, air compressors, ice machines and vertical dynamo and blower enines. In general, bearings of his nature are subject to very ttle wear, and they usually are llowed sufficient clearance to ermit of free and ready circuation of the lubricant. In horiontal engines and other similar nstallations where guide bearngs are involved, the lower earing carries the weight of the oving part such as the crosshead. In such cases the top earings serve practically enirely as guides, and are subject o relatively no load. Vertical uide bearings are usually subected to equalized pressures, hich are in general comparaively low unless the clearances re either abnormally slight, or re so high as to allow the crosshead to pound or slap against he bearing surfaces.

Ball and roller bearings, hough differing in design and onstruction, both embody the rinciples of rolling contact and re, therefore, subject to rolling friction. As their names imply, such bearings consist of either a set of perfectly spherical balls, or a number of solid cylindrical rollers of highly polished steel, which are carried in circular grooved rings or containers, known as races or cages. They surround the shaft, their innermost points rolling in close contact with the inner ring or raceway which is fitted to the shaft; the outermost points roll in contact with the inner circular surface of the bearing retainer or outer raceway, according to their design. Ball and roller bearings have a marked advantage over plain bearings, by virtue of their smaller area of contact. Theoretically ball bearings are subject to point contact, while roller bearings involve line contact. With both types there must be practically no freedom of motion other than rolling.

Ball bearings are claimed to have certain advantages over roller bearings in that (1) They never cause end thrust; (2) Their load carrying capacity is equal to that of roller bearings,



5 Mercury Tractors 2 Years' Service 0 Replacement Parts

ELECTRIC tractors are noted for their low maintenance cost. This naturally follows from the small number of parts and the simplicity of construction of such a machine.

It is all the more striking, therefore, when a new model tractor shows a marked improvement in this respect over the best of the existing models. This is exactly what the new Mercury Type-H has done.

Five of these machines that have been in service over two years have never required a single replacement part on the drive. This is a record for low maintenance which we are confident has never been approached by any industrial tractor on the market.

How The New Type-H Makes This Possible

Introduces a balanced internal gear drive of entirely new design, eliminating the friction losses inherent in the worm drive. This results both in low operating cost and an absolute minimum of upkeep for the "power plant."

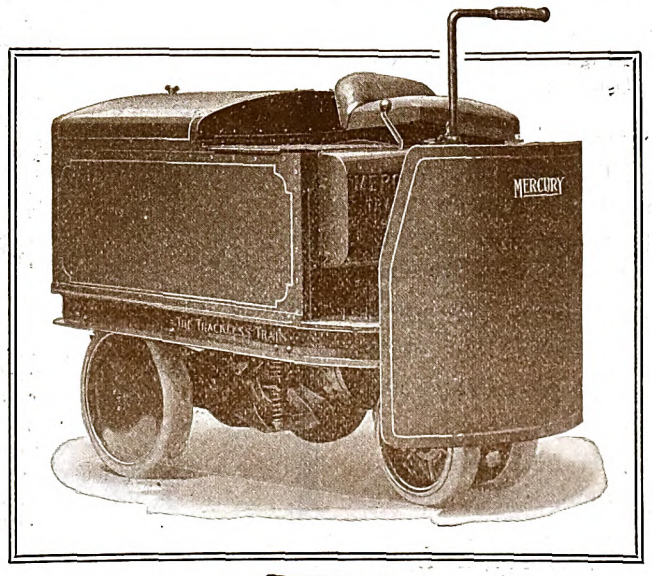
Retains all valuable features developed in previous Mercury models including:

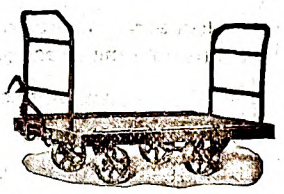
1. Special safety features effectively insuring against danger, even in the hands of inexperienced workmen.
2. Drum type controller of special design having long life, dependability, simplicity, ease of inspection and adjustment.
3. The exclusive Twin-3 front wheel assembly combining full spring suspension with the short turning radius of older 3-wheel models.
4. Frame of channels and angles hot riveted to combine maximum simplicity, rigidity and strength.

Fleet Owners

The Mercury organization pioneered in the field of electric industrial tractors, and for more than 8 years has made such tractors and trailers exclusively. It is therefore not surprising that a preponderance of all the large installations are 100% Mercury. A few of the large fleet users (over 10 machines) are the following:

American Railway Express Co.
American Radiator Co.
Armour & Co.
American Window Glass Co.
General Electric Co.
Endicott-Johnson Co.
United States Government
Studebaker Corporation
Sugimure Warehouse (Japan)
Willys-Overland Co.
American Car & Foundry Co.
Kewanee Boiler Co.
Eastman, Gardiner Lumber Co.
Standard Oil Co.
Union Stock Yards & Transit Co.
Pennsylvania Railroad Co.
Sears, Roebuck & Co.
Illinois Central Railroad
Lehon Co.
Morris & Co.
Swift & Co.
Miller Rubber Co.
Chicago Tunnel Co.
Chicago Union Station Co.
Chicago Burlington & Quincy R.R.
New York Central System





Trailers

And to complete the "Trackless Train" there are Mercury trailers of just as distinctive merit as the tractor. There are various designs for special purposes, but the A-310, illustrated above, is an all-purpose trailer which meets most all ordinary industrial conditions.

Mercury Manu[illegible]ring Company

THE TRACKLESS TRAIN

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and at high speeds claimed to be even greater; (3) They normally show less tendency to become overheated, due to their lower operating friction; and (4) They occupy less space per unit of load.

On the other hand, ball bearings possess certain disadvantages since (1) The greater need for accuracy in their construction often makes them more costly to install; and (2) It is impossible to replace them on long lines of shafting, etc., in case of failure, without considerable dismantling of equipment. Roller bearings, on the other hand, are usually built with both the cage and bearing liner in two halves, and can be readily replaced by rolling the desired half out from contact with the shaft.

Thrust bearings have already been briefly mentioned, in general. They are distinguished by the manner of their construction and the means employed to take up axial thrusts developed by the revolving parts, or the weight of these latter. A plain or sliding thrust bearing is, therefore, one where sliding motion is involved, collars being located on the revolving parts which transmit the pressure to a corresponding set of stationary collars in the bearing housing.

On plain thrust bearings the manner in which the lubricating oil is introduced to the bearing surfaces, and the oil film maintained is important. Lubrication will, of course, depend to a considerable extent upon the intricacies of design and construction.

Variations in the design of discs or bearing collars are sometimes tried out and attempt is often made to simplify the step bearing in particular by use of one or more collars, according to the pressure involved. Still, the single collar thrust bearing, regardless of speed or pressure, is considered as the most reliable. In such a bearing the collar (often known as the foot-step) rides on a set of fixed segments which comprise the bearing surface. Each of these segmental pads is built capable of pivoting or rocking independently and thus assuming whatever inclination to the moving surface the pressure, speed or body of the oil may require. Although there is practically no metallic contact, these bearing pads are usually faced with bearing metal in order to insure protection of the foot-step in event of improper lubrication or the entry of abrasive material.

Thrust bearings of this type may contain a varied number of pads. As a rule, however, six is the maximum. Such bearings can be applied to horizontal as well as vertical installations. The essential characteristics in a plain thrust bearing lubricant is the viscosity. Compound is unnecessary, and straight mineral oils are preferable. The requisite viscosity will, of course, depend upon the size of the bearing, the oil pressure, and the speed and operating pressure of the machine.

Ball and roller bearings are also variously used in certain types of thrusts. Where roller bearings are employed they are usually fitted with tapered rollers. For such service they must be extremely accurately machined and fitted, otherwise abnormal end thrust will be developed. Where end thrust is minimum, friction will be independent of lubrication. The occurrence of any appreciable end thrust, however, will cause friction to be developed between the

(Continued on page 78)

Who Makes the Rules and Why?

It's against the rules to allow most recording instruments to stray from a limited "working range." You must keep off the grass.

To play safe you must use an instrument with a much wider chart scale than is necessary. One that's usually difficult to read accurately.

Manufacturers are forced to make such rules because of the inherent weakness of the actuating movements of their instruments.

When the Foxboro Improved Helical Tube Movement was perfected 2½ years ago Foxboro Recorders were immediately freed from such obsolete rules and restrictions.

Foxboro Recorders are not hobbled within a limited "working range."

Select a Foxboro Pressure Gauge or Thermometer with the scale range that's easiest to read.

Use it constantly at maximum range if you wish.

The Improved Helical Tube Movement will not fatigue, split, leak or crack even when subjected to excess pressures that carry the pen way beyond the outer edge of the chart.

It is permanent in calibration. No adjustments are required to maintain its accuracy.

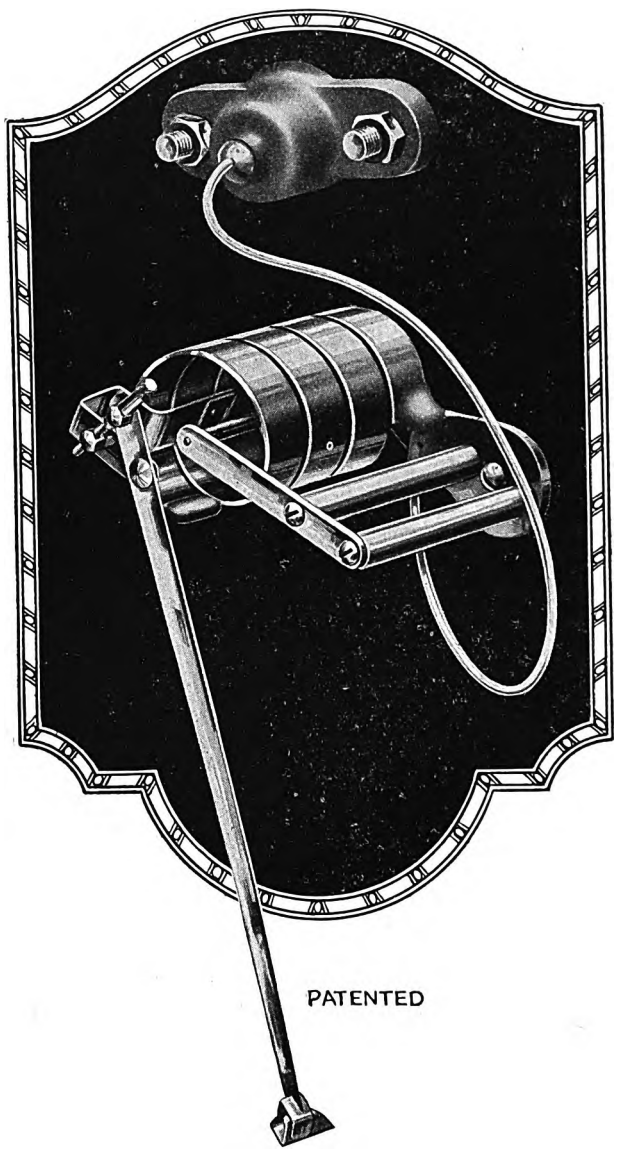
Accuracy within less than 1% of total scale reading is guaranteed.

The Foxboro Improved Helical Tube Movement is a great achievement in recording instrument construction.

Rules required to keep less sturdy instruments in calibration do not apply to the Foxboro Movement.

For accuracy, dependability and convenience install Foxboro Recorders, the only instruments with the Improved Helical Tube.

Write for Bulletin 154-A.



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re Your Material Handling *"Economies"* Wolves in Sheep's Clothing?

"What is the price of your platforms?"

Many a time the prospect's interest seems to center in the answer to this question. And, too often, the lowest price gets the order!

The result is a saving, true, but it's a "wolf in sheep's clothing!"

He can't understand why a platform must be as strong and wear-resisting as a lift truck.

So he compromises. He buys platforms that he is told are "just as good" as Stuebing "Steel-Bound."

He overlooks the significant fact that *if they were really just as good they'd cost more than Stuebings!*

You can take your choice! Either you can save money *on* platforms, or you can save money *with* them. *But* you can't do both!

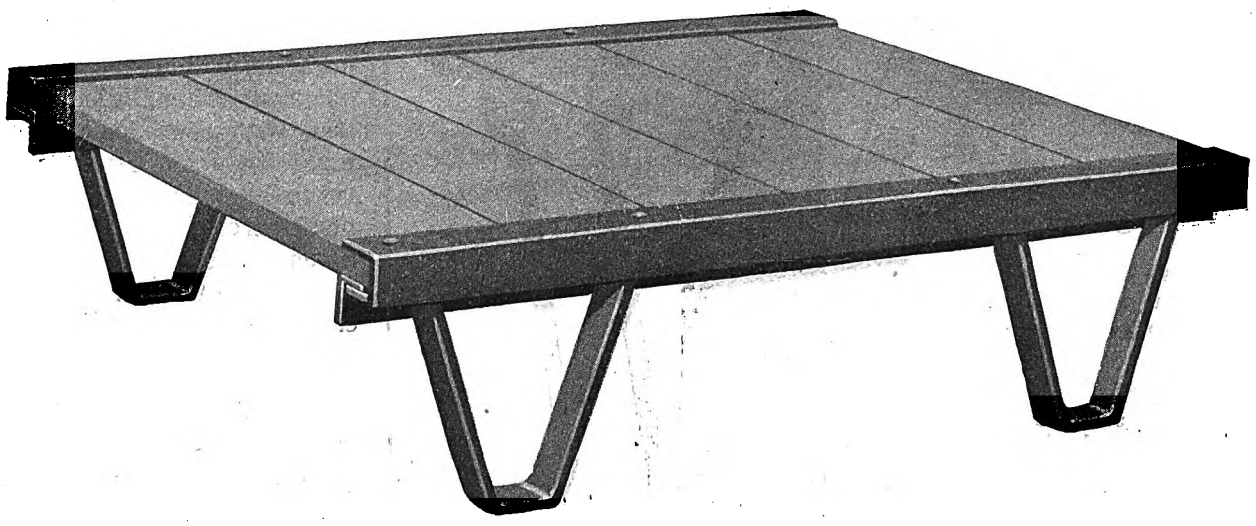
And the only real, tangible *savings* are those day by day economies which are earned by staunch, dependable equipment that does your bidding without falter.

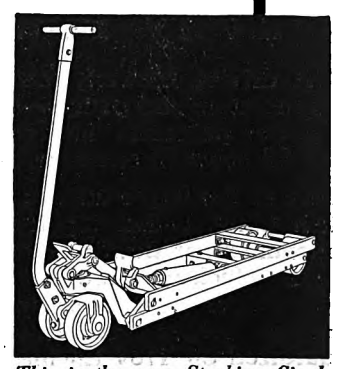
There is no substitute for the lifelong, trouble-free service of a "Steel-Bound" Platform. When you use these platforms and Stuebing Lift Trucks each is the equal of the other—*and both are unequaled by any other made!*

Ask any one of the big industries of the country why they pay the slight additional cost of "Steel-Bound." They'll tell you it's the most economical platform they have ever been able to find. Isn't that what *you* want?

Use the coupon below and let us give you facts that most certainly will be of interest—*and profit.*

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This is the new Stuebing Single Side Lift—a revelation in lifting ease, in convenience and in safety of operation and economy of service... There are Stuebing Lift Trucks of every kind and size to meet every interior hauling need

1 *Steel-Bound the full length.* Powerful clamping prevents sagging. Strongest where ordinary platforms are weakest.

2 *Forged steel bolts* with large heads anchored in the steel rails clamp oak top, side rails and steel legs together in a vise-like grip.

3 *Forged steel legs* support heaviest loads indefinitely. Won't wear down or wabble. Broad smooth surface prevents damage to floors.

4 *Oak top,* of selected wood. A wear-resisting surface that protects fragile materials from chipping and holds machine products from slipping.

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(*Continued from page 76*)

roller cage and the runway, and straightaway lubrication will become of decided importance. The better the oil films naturally the more effectively will such friction be overcome, especially at high operating speeds.

Grease and oil are both used for the lubrication of ball and roller thrust bearings. As a rule it is well to keep to as low a viscosity in the lubricant as possible, due to possibilities of internal friction being developed. In ball bearings friction will be oftentimes greater when even a light lubricant is used, than when the balls are run dry. The function of the lubricant is largely to serve as a preservative for the highly polished metallic surfaces involved. The construction of the bearing housing and the operating temperature will influence the choice of the lubricant, a light grease or medium viscosity oil being selected according to the tendency there may be for leakage from the housing, etc. Grease, in any case, will prove the more effective seal against dirt or dust.

Another type of thrust bearing is the "horseshoe," which is chiefly employed in marine service. On shipboard the thrust bearing is the connecting link between the engine and propeller shafts, and its function is to take up the axial thrust exerted by the propeller shaft, transferring this thrust to the hull of the ship and keeping it from reacting upon the engine. The typical horseshoe thrust bearing consists of a length of shaft equipped with a number of collars which press against an equal number of horseshoe shaped yokes set in the bearing block. These are capable of adjustment along the line of the shaft in order to facilitate equalization of pressure. The faces of these horseshoes are babbitted in order to permit of renewal in event of abnormal wear occurring through sliding contact with the shaft collars.

Of course, lubrication of the thrust bearing in a marine installation is a decidedly important factor. Variations in temperature, differences between any of the shaft collars and horseshoes may readily bring about an unequal distribution of load with consequent overheating. To eliminate this occurrence as much as possible the most careful attention must be given to lubrication. Wick feed in conjunction with bath lubrication is generally employed on a horseshoe type thrust bearing, the wick feed receptacles being built into the tops of the horseshoe yokes, and the base of the bearing serving as an oil reservoir. This latter is kept sufficiently filled with lubricant and the shaft collars run with their lower parts submerged.

The various fluid, semi-solid and solid lubricants that are used for the lubrication of bearings in general, are of interest. Where and when to use any one of these naturally will depend upon the type of bearing, the lubrication system installed and any intricacies of operation involved. In general we must consider the effect the lubricant will have in bringing about a decrease in

(1)—Power transmission losses.

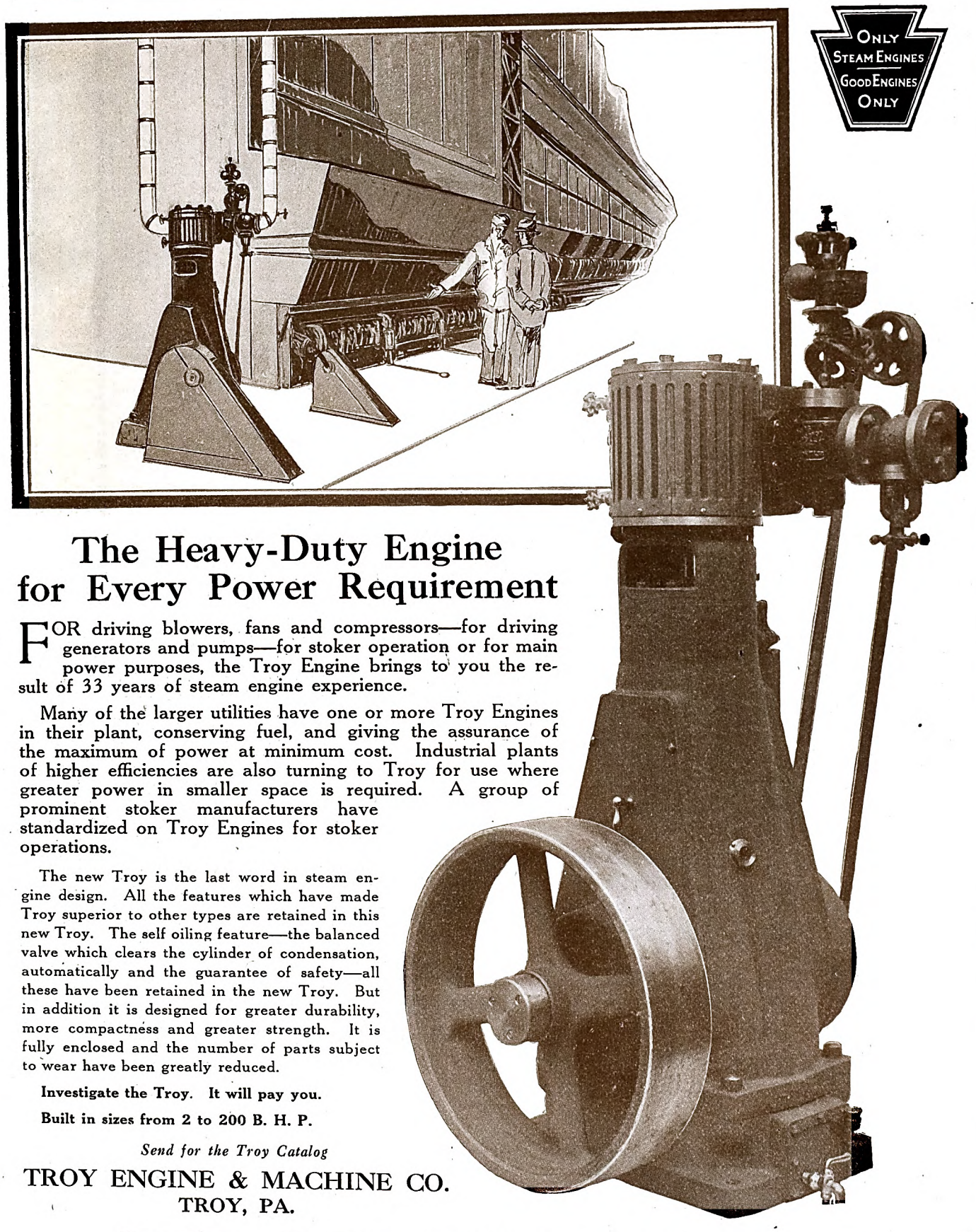
(2)—Bearing friction losses.

(3)—Time losses in event of repair.

(4)—Necessity for replacement of parts.

All these if reduced to a min

(*Continued on page 80*)



The Heavy-Duty Engine for Every Power Requirement

FOR driving blowers, fans and compressors—for driving generators and pumps—for stoker operation or for main power purposes, the Troy Engine brings to you the result of 33 years of steam engine experience.

Many of the larger utilities have one or more Troy Engines in their plant, conserving fuel, and giving the assurance of the maximum of power at minimum cost. Industrial plants of higher efficiencies are also turning to Troy for use where greater power in smaller space is required. A group of prominent stoker manufacturers have standardized on Troy Engines for stoker operations.

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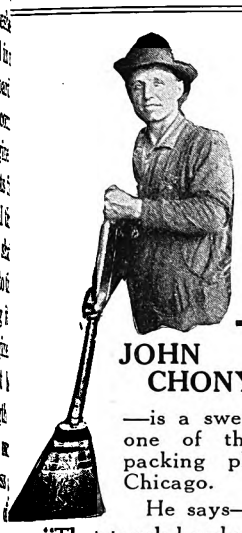
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JOHN CHONYSKI—

—is a sweeper for one of the large packing plants in Chicago.

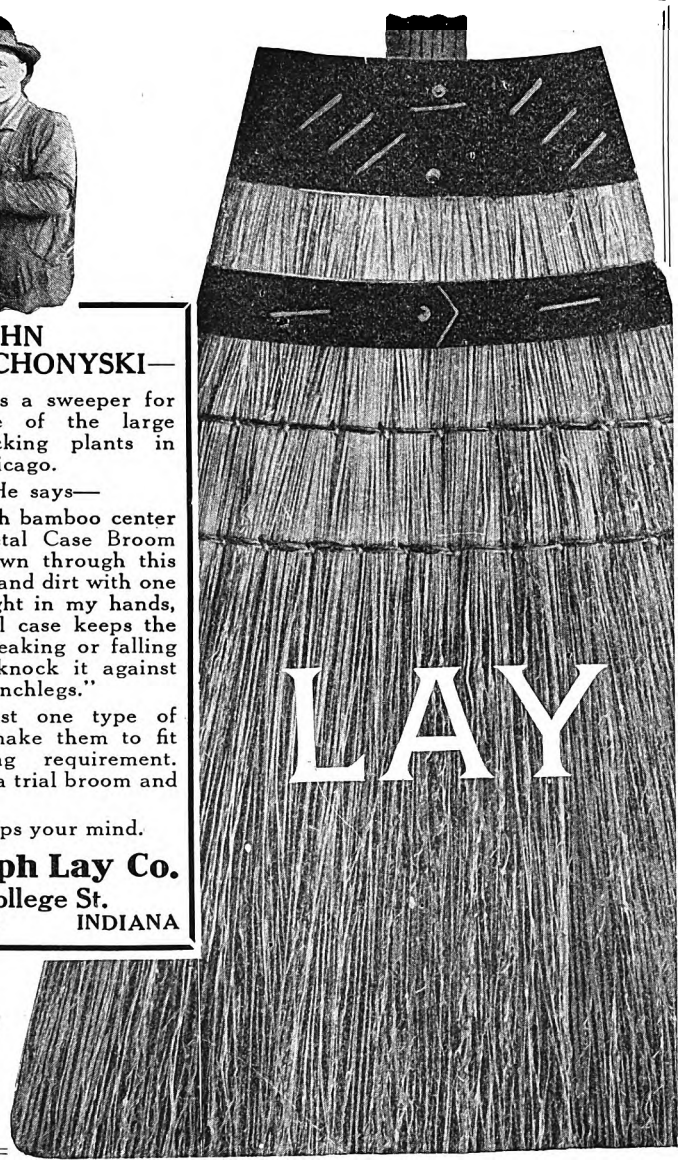
He says—

"That touch bamboo center in a Lay Metal Case Broom cuts right down through this heavy grease and dirt with one push. It's light in my hands, and the metal case keeps the fibre from breaking or falling out when I knock it against those iron benchlegs."

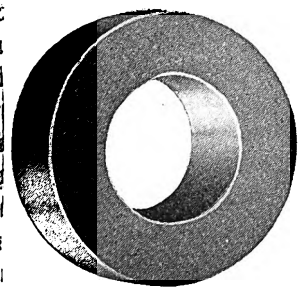
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The Joseph Lay Co.
120 College St.
RIDGEVILLE INDIANA



"They hold their shape till worn to a stub"



The Why of Ring Crushing

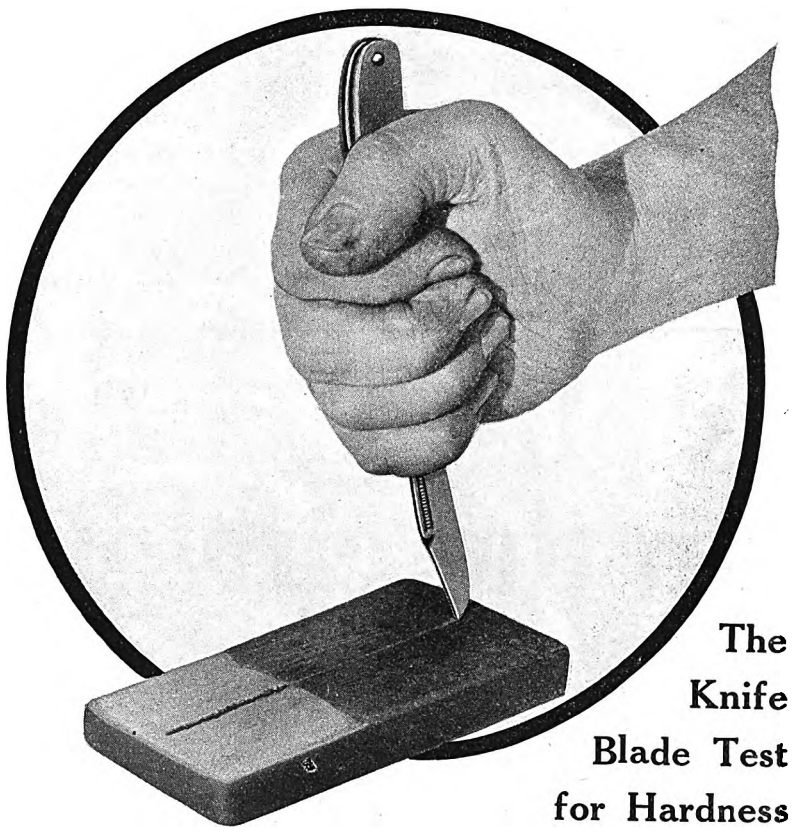
KINETIC energy is the only force that can be utilized under the old methods of crushing—and we know that as kinetic energy increases, power cost likewise increases. But now the ring method of crushing takes advantage of a one and three-fourths ton centrifugal force behind each of the great manganese rolling rings and applies it ten times each second.

This cost-free centrifugal force added to the kinetic force accounts for the performance at low speed of ring crushing and pulverizing. That is why it presents an operating economy heretofore unknown.

We have detailed reports telling just how this power economy is asserted in handling various materials. Tell us the material you want to crush.

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American Ring Crushers



The Knife Blade Test for Hardness

TRY THIS TEST AT OUR EXPENSE:

Ordinary concrete floors are so soft that a knife will easily scratch the surface. However, if the very same floor is Agatized, it becomes so hard that the knife slips off without scratching.

To demonstrate this to you, we want to send you a small cement slab, finished exactly as your cement floor is finished. One half of the slab has been chemically **hardened** with Agatex—the other half left untreated. The knife scratches quite easily into the ordinary cement, but on the Agatized portion it slips off like hardened steel.

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Can you picture the difference such a treatment would make on your own concrete floors? All "sanding" and dusting is stopped immediately. Your floors take harder wear and last probably twice as long.

Agatex saves building owners thousands of dollars each year on Concrete Floor Maintenance. Its cost is very small—it is easy to apply (mixed with water and swept into the floor with a broom): Agatex hardens concrete by chemical reaction.

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Our cement floors measure .... ft. x .... ft.

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(*Continued from page 78*)

mum will automatically promote increased production and greater efficiency in operation.

Fluid lubricants include all products, regardless of their nature, which are capable of flowing at room temperature and are used for the purpose of lubrication or the reduction of friction. Most commonly, fluid lubricants are understood to cover petroleum oils, animal, fish and vegetable products. Thus, steam engine oils, castor, cottonseed, neatsfoot and whale oils, etc., all fall under this category. Water is also an effective lubricant in certain cases. Petroleum oils consist chiefly of hydro-carbons, that is, a more or less complex association of hydrogen and carbon. They are capable of fractional distillation whereby the crude oil can be broken down (by action of heat) into several components of varying boiling points. The viscosity and other characteristics of each will be different. The viscosity is one of the chief determining characteristics of any lubricating oil. Vegetable and animal oils cannot be subjected to distillation without a certain amount of decomposition. They are therefore called "fixed."

The extent to which these oils will be applied to ing lubrication will largely upon the service to they are subjected. properties such as vis pour test, oiliness, carbon due, etc., must prac always be taken into con tion.

Then we have what are as semi-solid lubricants o ucts which will not flo mally at average temper Among these are tallow residual mineral produc In general semi-solid lub also include greases o pounds of mineral oils an onified fatty products, v and the various grades of latum. As a general rule mineral products such as p latum residual gear lubric or the compounds known as sponge and railroad grea which are mixtures (or intim emulsions) of mineral lubric ing oils and soaps from anim fats, etc., are chiefly used for lubrication of industrial bear ings.

The substitution of greases o semi-solid lubricants for fluid lubricants is frequently a much-discussed question among industrial engineers. As a point of information it is safe to say that grease should be used:

1. Where the oil cannot be retained within the bearing clearance space on account of high operating temperatures, pressures, or slow-rubbing speeds.

2. Where any liability of oil drips or splash might involve damage to belting or other materials.

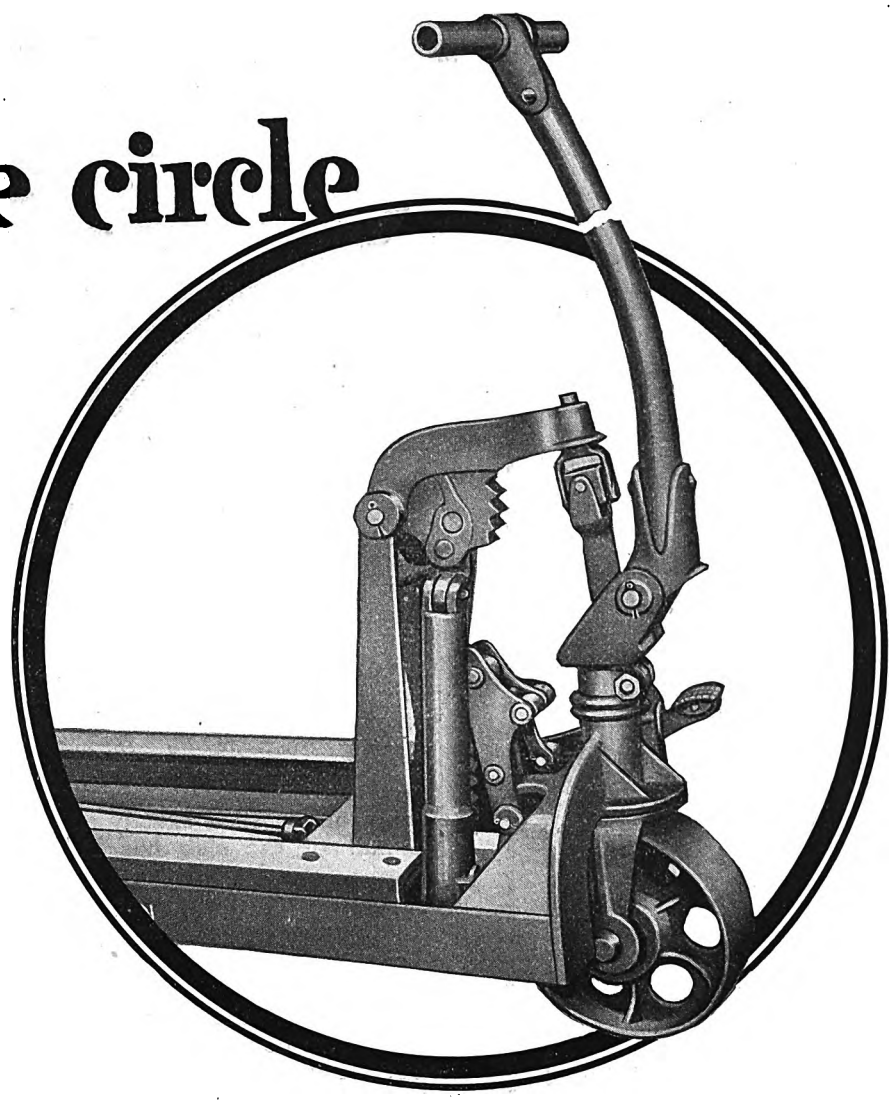
3. Where the bearing is subjected to repeated shocks, as on the automobile chassis, which might break the lubricating film.

4. Where positive lubrication is desired, using as little lubricant as possible, but with still sufficient reserve to enable the bearings to operate with little or no attention for a considerable period of time. Inaccessible bearings where grease cups are in use, and where oiling would require the shutting down of the machine for lubrication, are typical examples.

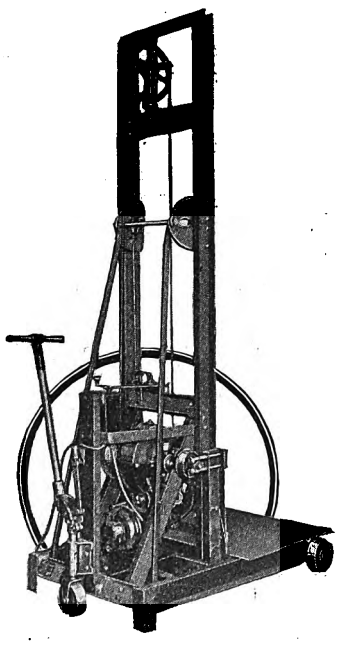
5. Where higher operating temperatures are involved.

(*Continued on page 82*)

it's all in the circle



Note the space between handle and load. (Every Lift Truck, except JACKLIFT, has such lost space.) JACKLIFT takes advantage of this space to put in the dependable Jack with large, strong, easily accessible parts. A Jack is the oldest and most reliable means for lifting loads easily. JACKLIFTS elevate 8000 lbs. as easily as 2500 lbs. Their simple, rugged parts permit an easier lift, higher lift, a lift in less space (handle to the side), and the absolutely vertical lift. These are not generalities. They are proven superiorities of JACKLIFT,—the Master Elevating Truck.



Worm drive operating in oil bath. No exposed gears. A remarkable advance over all Portable Elevators yet produced. Observe that handle swings to side and reduces operating space.

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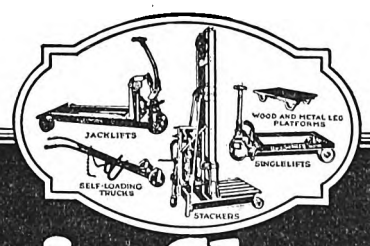
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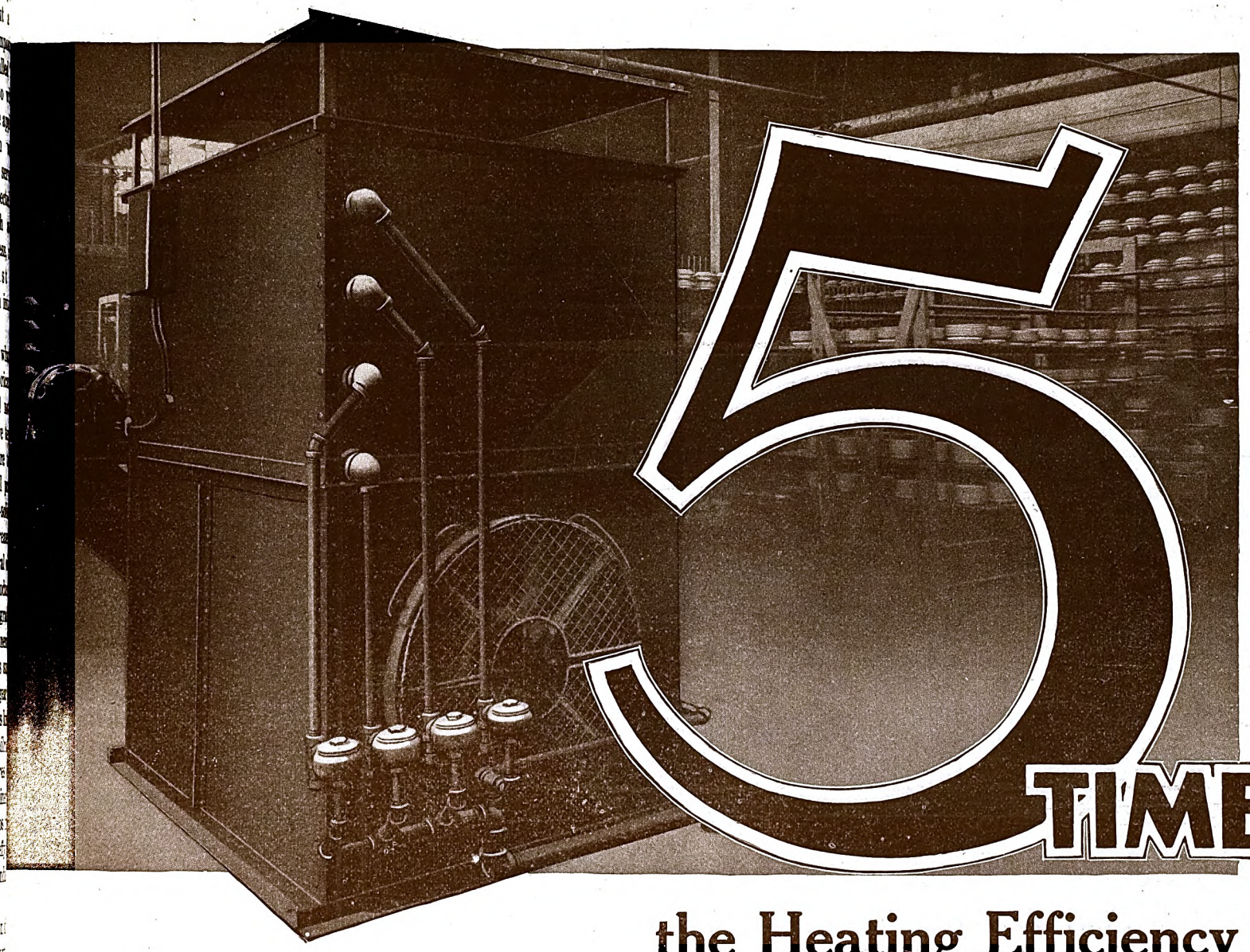
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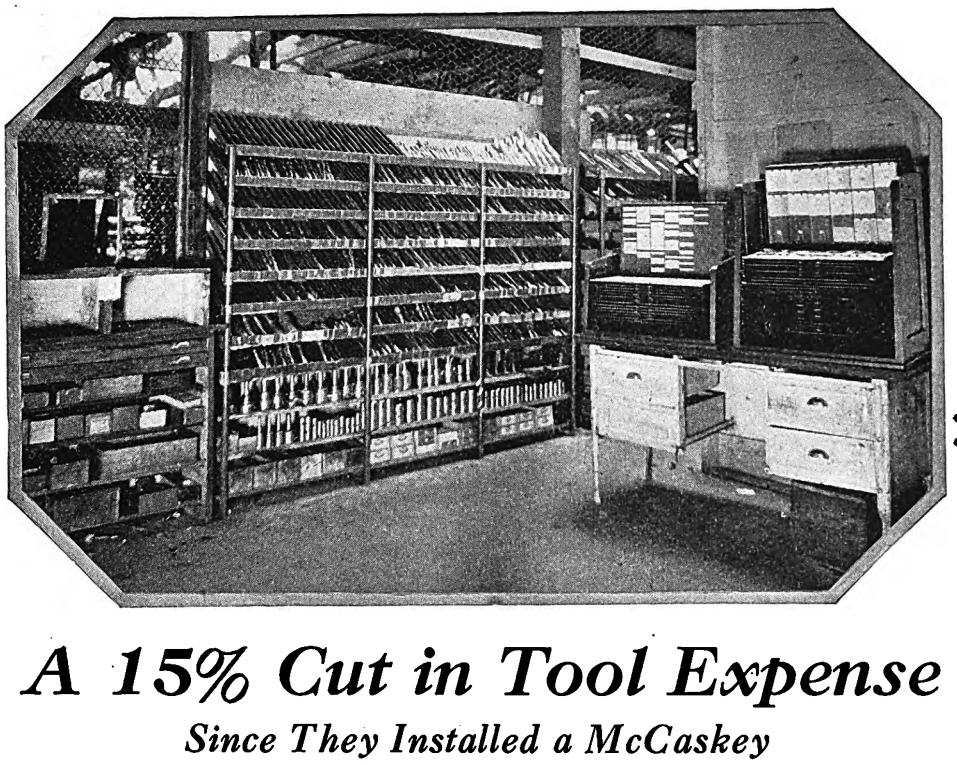
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(*Continued from page* 80)

6. Where the lubricant must "stay put" on account of its physical characteristics, regardless of whether the machine is idle or in motion.

Our Third Classification, solid lubricants, includes a number of relatively solid materials. Among these are graphite and unctious substances such as soapstone, talc, etc. Solid lubricants may be used either alone or in various combinations with fluid lubricants, such as mineral oils. For example, there are the several mixtures of graphite and oil so often used for more or less special conditions of lubrication. Solid lubricants alone, however, are seldom used for actual lubrication in industrial practice. More particularly have they been found of certain value when it has been necessary to cool down an overheated bearing. White lead and flowers of sulphur are two substances sometimes used for this purpose.

As a lubrication study, this matter of bearings and their application to industrial machinery is of especial interest, inasmuch as such machinery involves perhaps a greater variety of types of bearings and methods of lubrication than any other field of engineering. A preliminary study was made in INDUSTRY ILLUSTRATED for April, 1923, when the author discussed the various methods of lubrication and types of equipment involved, more or less in the order of their development. It can be appreciated that the application of any particular method or system will depend, of course, upon the intricacy of the machinery involved. Naturally a certain amount of knowledge concerning both lubricants and bearing construction is necessary. With this available, and a remembrance of the fact that bearings will in general carry the brunt of the burden in practically any type of machine, the question of bearing lubrication should rarely prove difficult to the average layman, provided he, of course, uses high grade, properly refined lubricants and doesn't let economy run away with common sense.



In the Richards-Wilcox Plant, Aurora, Ill.

A 15% Cut in Tool Expense

Since They Installed a McCaskey

THAT'S what actually happened in the plant of the Richards-Wilcox Manufacturing Company at Aurora, Ill. But it's only one of the surprising benefits they derived from their McCaskey Register—benefits that may be yours as well. Read the others in the following letter of Mr. R. H. Bellmore, Assistant Superintendent and Production Manager:

"A reduction of over 15% in tool expense, the releasing of hundreds of dollars formerly tied up in over-stocked tools, the saving of many dollars lost in idle time and in holding up production while hunting for dies, jigs, etc., are some of the results we have accomplished in the past year with our McCaskey register.

"Now when a workman needs a new tool, a die, jig or sample he has just one place to go—our tool room. Before, each foreman kept a supply of tools in his desk, and no record was kept of who used them or when they were used. The dies and jigs had no definite place. To get anything from the tool room now, the workman must fill out a form in triplicate showing the tool, jig, die or sample drawn, the date, department and the signature of the workman. The original is filed in the McCaskey workman's register under the workman's number. A pink triplicate is filed in the McCaskey tool register under the number of the tool, and the yellow duplicate is given the workman.



Making the Workman Careful

"The workman has to account for everything charged against him in the register, and if tools are broken through his carelessness, or are lost, he has to pay for them. Naturally he is much more careful, and as a result we are buying over 15% less tools than formerly. We know too, just what tools we need and what we don't need. We used to order a large quantity of everything when we ran low. Now we order according to how fast we use the tools, and thus we are not tying up our money in slow moving stock.

"When a workman is through with a die now he brings it back to the tool room instead of throwing it down anywhere and forgetting it. We used to spend a day or two at a time looking for lost dies and jigs. That meant idle workman's time to say nothing of the loss due to held-up production. Everyone is enthusiastic about the savings we have effected through the installation of the McCaskey. And even the individual workman is more productive because McCaskey has made him more careful."

And in Your Plant—

You, too, no matter what your business may be can derive benefits of this character by installing a McCaskey System designed for your needs. It is no trouble to find out about them. Write us today.

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Here will be assembled in Boston for the first time the very men whose sole job is to buy and who are the men on whom manufacturers are concentrating their sales efforts week in and week out. And now, for an entire week, instead of the purchasing agents sitting in their offices and being visited by your salesmen, they will be here in Boston away from home and routine office cares, ready and willing to be shown whatever manufacturers have to show them. The Convention is really the manufacturer's opportunity. It is up to the producers throughout the country to show the purchasing agents why and how their products are superior and why their order blanks should bear the name of those products on the next purchase of supplies, equipment, or products of any sort.

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Two Successful Plans

By W. J. McNULTY.

T. S. SIMMS AND COMPANY, a firm which for fifty years has manufactured brushes and brooms at St. Johns, N. B., is decidedly of the opinion that a works council is beneficial to the interests of an industrial concern.

This company introduced a works council system into the plant. The first plan proved inadequate and a second plan was substituted by mutual agreement between the firm and employees. The second plan has brought ideally to promote harmony between employer and employees. There has been no industrial trouble since the institution of the second plan. The plant has not been affected to even a minor degree by labor troubles.

Regular meetings are held in the assembly hall of the plant, these meetings being attended by employees and members of the firm including the heads of the various departments. There various questions are discussed and an amiable adjustment made of each grievance. committee composed of members of the firm and delegates elected by the employees meets regularly also, to discuss topics of mutual interest to employer and employees.

Under the works council plan adopted by this manufacturing concern, a compensation scheme for all employees who are injured or are ill has been included. Each employee contributes a per capita assessment yearly to the general fund, and the firm contributes a like fee.

The number of grievances has been reduced about sixty per cent. since the introduction of the Simms working council plan. The production of the plant has been greatly stimulated, and the efficiency of the employees has been greatly increased. The number of defective brushes and brooms is now the veriest minimum. Wages have not unduly increased and exorbitant demands have been made on the firm by the employees, who are now manifesting deep interest in the welfare of the firm.

The Eastern Manufacturing Company, manufacturers of men's clothing and women's clothing in St. Johns, N. B., was troubled for several years by habitual and occasional tardiness on the part of employees in reaching work in the mornings, and following lunch at mid-day.

A number of employees had been discharged because of this tardiness, the late arrivals having upset the morale of the plant, as well as interfering with production. But it was found that in most of the instances where dismissals were made, competent workers were lost to the plant and these were

EUCLID

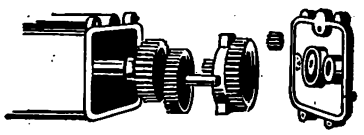
CRANES HOISTS

"RAISE PROFITS"

"—AND THEN THEY TRIED A EUCLID"

EUCLID for PERMANENT PERFORMANCE

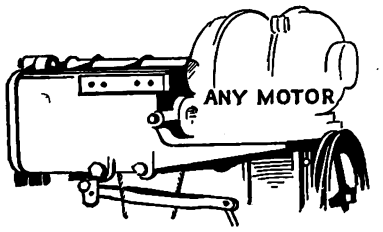
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Skilled mechanic not required.
Disassembled without removing hoist.

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Frame one piece—accurate alignment.
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Unfailing brakes and limit switches.

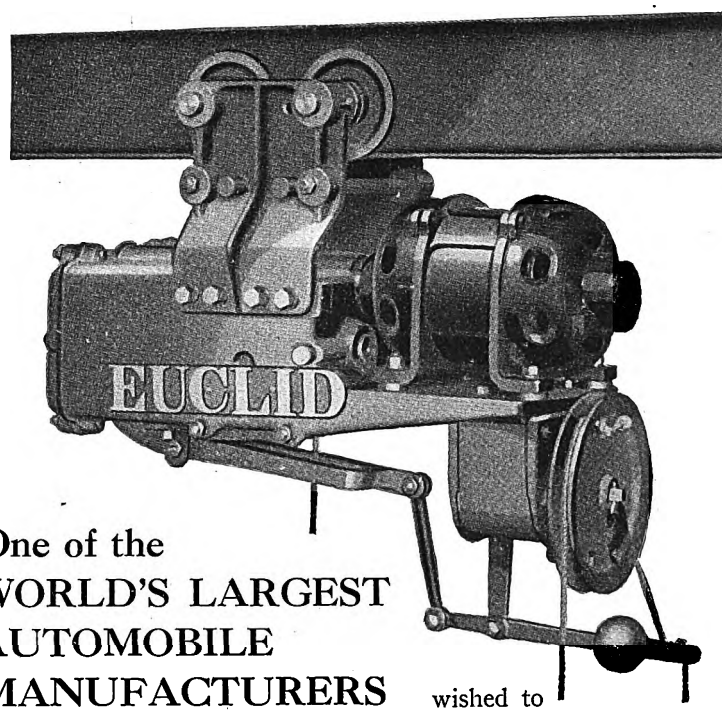


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Parts enclosed in oil bath.
All parts to jig—interchangeable.

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After various makes of electric hoists had failed to show the necessary durability and dependability — THEY TRIED A EUCLID.

It was an immediate and Striking Success!

Since then Euclid has been **STANDARDIZED** and performs all hoisting operations in that immense factory. (Name on request.)

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eagerly engaged by rival concerns, who were ready to overlook the tardiness because of efficiency in other respects.

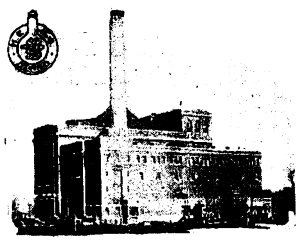
The Eastern Manufacturing Company had found its plant virtually demoralized, because of the dismissals and the necessity of replacing the skilled workers by new hands, with the attendant inefficiency for more or less extended periods, often stretching into months.

Something drastic was required to restore the production of the plant to normal status. Several plans were advanced, but each was rejected because of glaring deficiencies.

It was finally decided to start a "Be On Time Contest." Under the rules of this contest, each employee, who at the close of the month had the cleanest record in reaching work on time, would receive a cash prize of five dollars, and the second prize would amount to two dollars. The third prize would be a ticket to one of the night performances in a local theatre. In addition, it was announced as an extra incentive, that leaders in the "Be On Time Contest" would be rated high for promotion, and increase in wages.

The remedy for the tardiness was found in the contest, which is continued each month since the introduction of the plan. Tardiness has been decreased sixty-five per cent., and indications are for further improvement. Each month conditions are improving. The morale of the plant has been restored and the production has been considerably stimulated. The Eastern Manufacturing Company executives feel they now have the panacea for the tardiness evil.

AUTOMATIC REFRIGERATION
in the Industrial Field



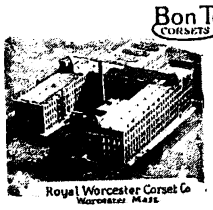
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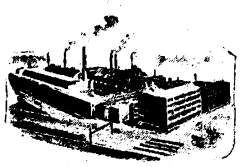
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Investigate the AUTOMATIC of Hartford To-Day

AT a recent meeting of the Conference Board of Physicians in Industry in New York some valuable hints on the use of iodine in industrial and other accidents were embodied in a recommendation which has just been made public by the physicians' organization.

"Tincture of iodine," says the statement of the physicians, "should be used only in and around the wound. It should be applied within eight hours after the injury occurs—the sooner the better.

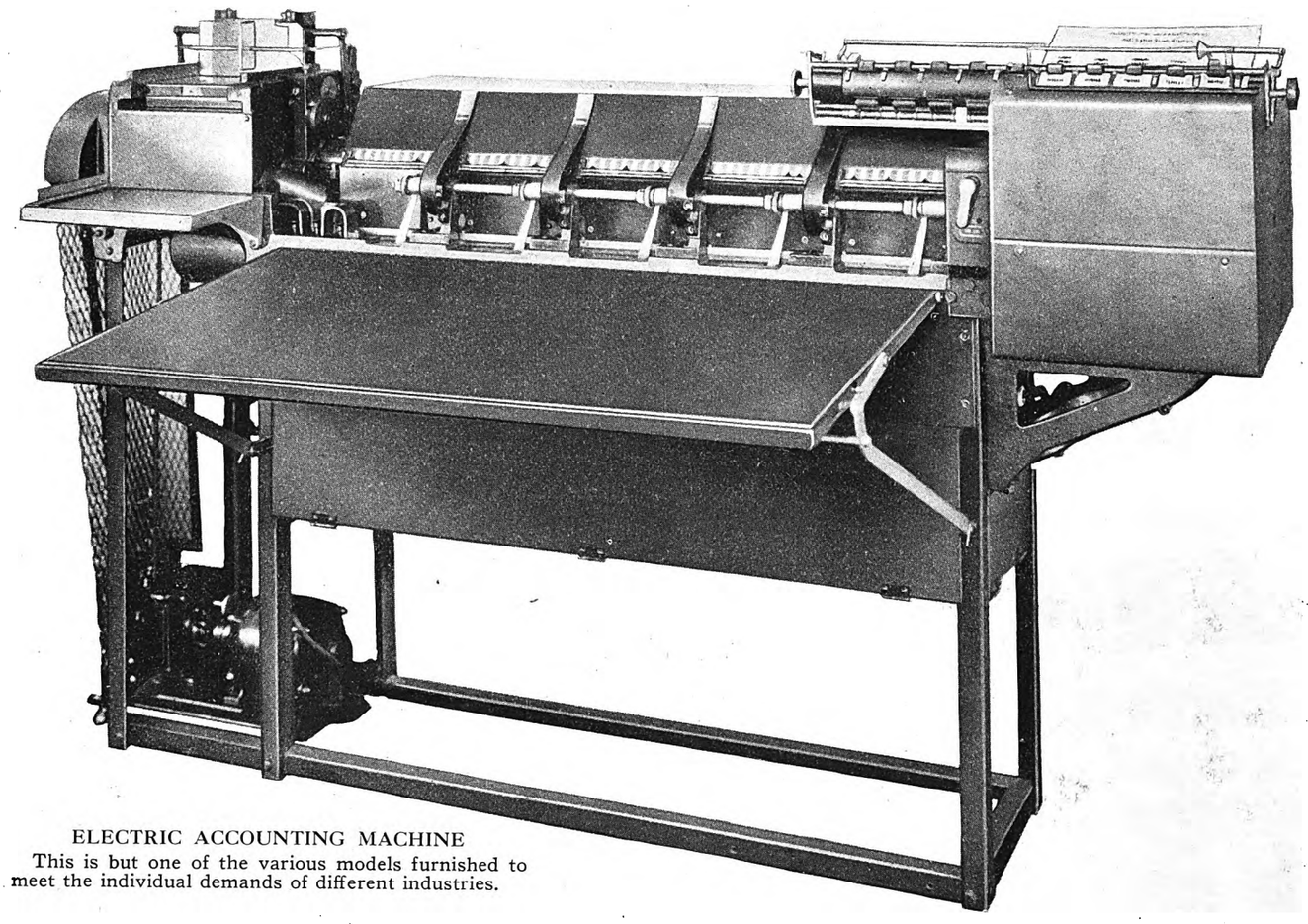
"Every skin, no matter how clean it may appear, has thousands of germs on its surface ready to poison a fresh wound before Nature can build a defense against them. If iodine is applied immediately, or a short time following the injury, these germs are destroyed before they have a chance to infect the wound. If application of iodine is delayed beyond eight hours the germs will have grown into the wound so deeply that the iodine will not reach them.

"One thorough application of iodine is enough as it has no healing properties. It should not be applied too strong, as sometimes occurs when the solution has been made stronger by leaving the cork out of the bottle and allowing the contents to evaporate.

"Apply folds of gauze (bandage, not cotton) directly to the wound. Never soak the gauze in iodine as this will burn the skin. Never use tincture of iodine on unbroken skin surfaces as it frequently irritates and often blisters, producing in turn a wound that later may become poisoned."—*National Industrial Conference Board.*

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This is but one of the various models furnished to meet the individual demands of different industries.

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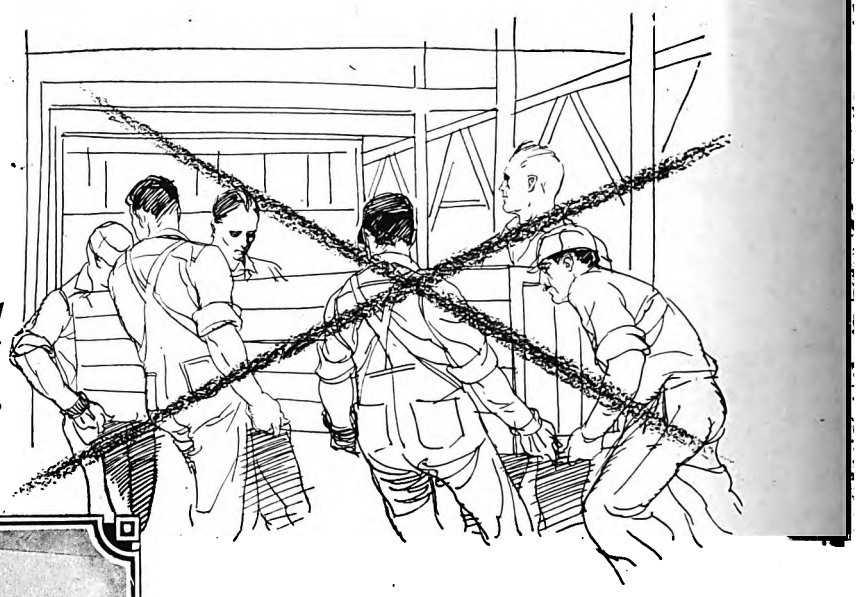
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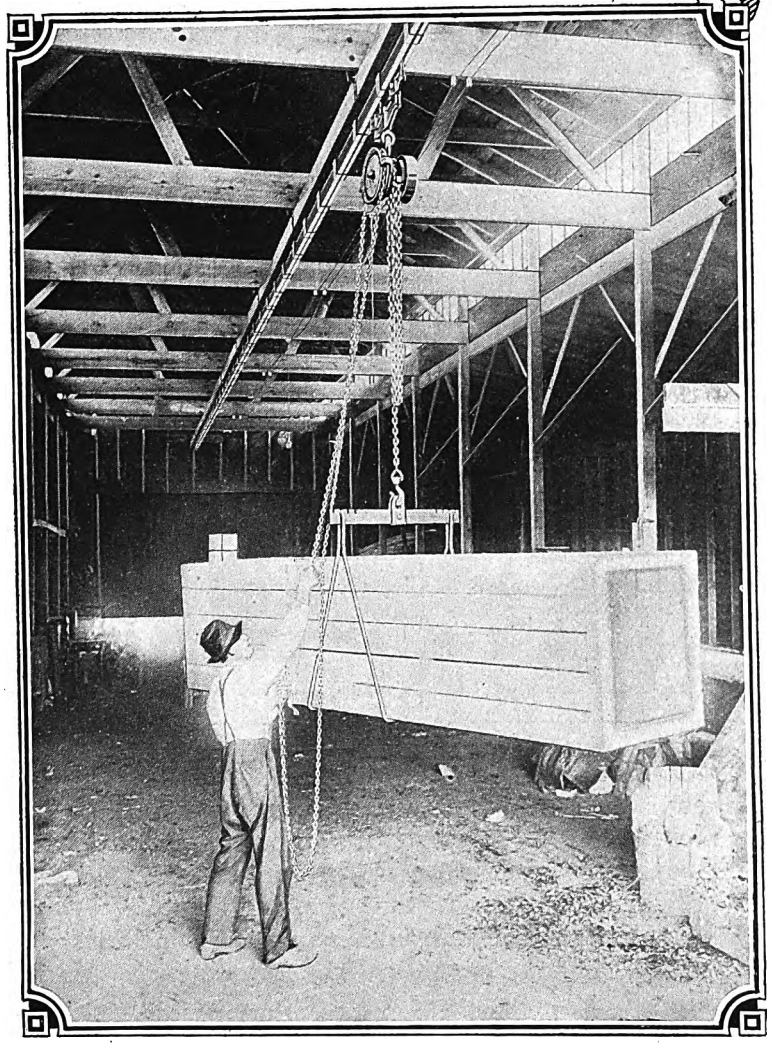
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Quality leaves its imprint

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Showing how one man, with the aid of OveR-Way, can lift and transport a heavy case which would try the strength of five or six husky men. This is a visible demonstration of the superiority of the OveR-Way method of doing heavy handling as against the antiquated and wasteful "gang-way."

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Our Engineering Department stands ready to show you how *OveR-Way* can readily be adapted to your particular requirements, and submit complete plans and specifications for an installation that will repeatedly pay for itself. This service is given without cost or obligation to any manufacturer who earnestly desires to modernize his plant.

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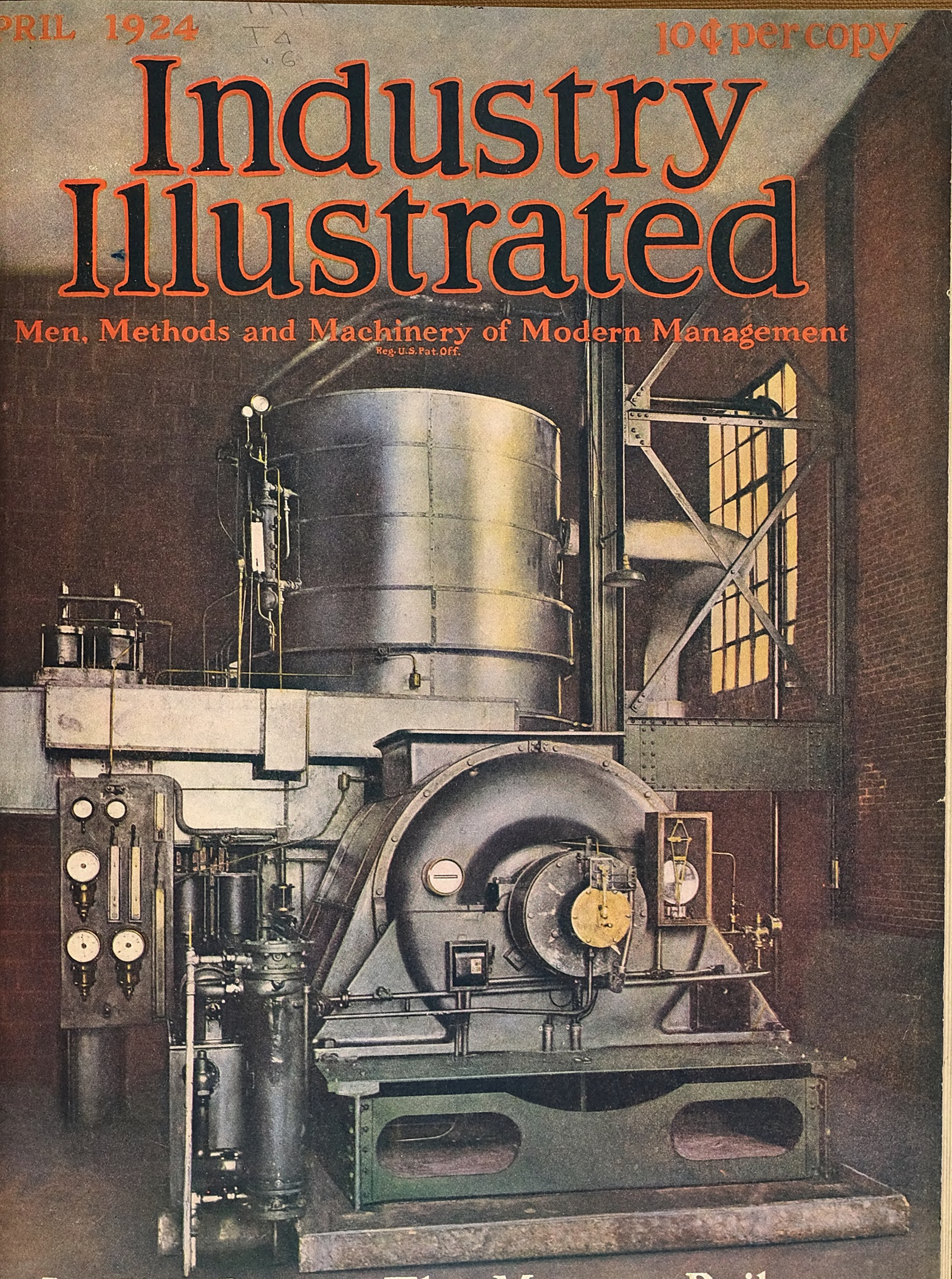
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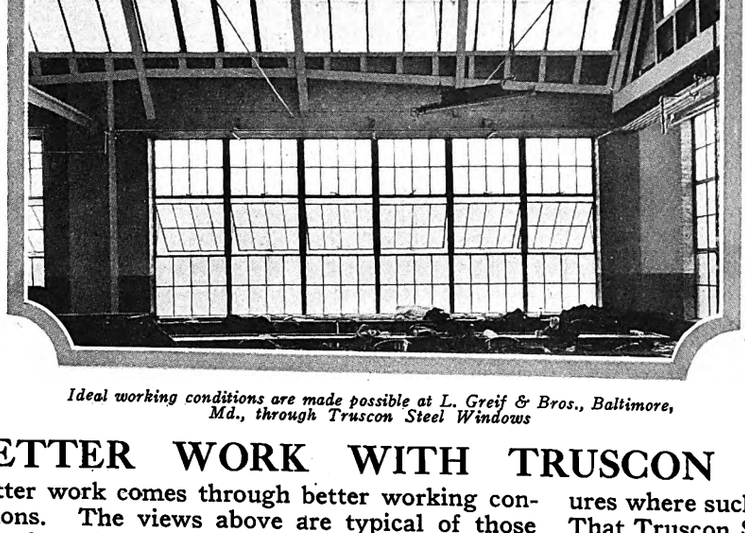


In This Issue—The Mercury Boiler

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Truscon Steel Windows used throughout the plant of the Narrow Fabric Co., Reading, Pa., illustrated above—constructed by Stone & Webster, Inc.



Ideal working conditions are made possible at L. Greif & Bros., Baltimore, Md., through Truscon Steel Windows

Steel Windows for Industrial Plants

Daylight, good ventilation and fire protection are too valuable to overlook in the industrial field. The nature of many businesses makes these factors absolutely essential to their successful operation.

Truscon Steel Windows provide maximum daylight, fresh air and protection against fire, storms and decay. They add greatly to the appearance of any building in which they are used.

Why be satisfied with inadequate, inefficient windows when Truscon Steel Windows offer so much for so little?

BETTER WORK WITH TRUSCON STEEL WINDOWS

Better work comes through better working conditions. The views above are typical of those manufacturing plants where modern methods include Truscon Steel Windows with their many advantages to both employes and owners.

It is easy to visualize the jump in production figures where such working conditions are provided. That Truscon Steel Windows do make a big difference is a recognized fact and has been proven by their use in numberless specialized industries.

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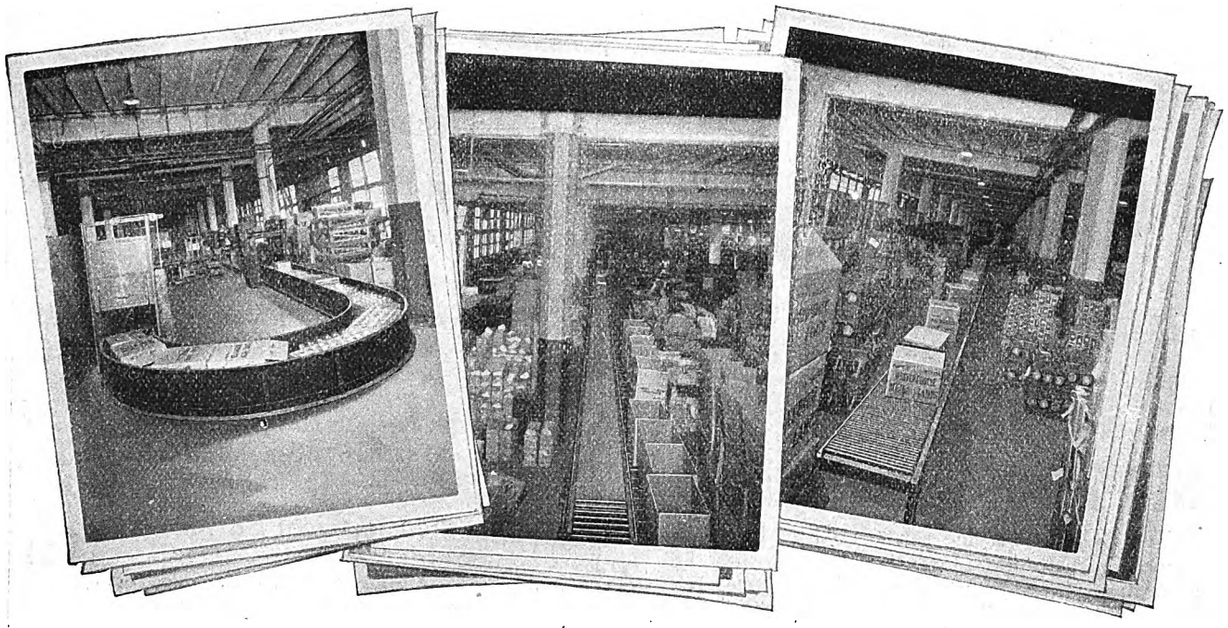
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Westinghouse–*another user*





Photographs at top show both gravity and power types of Dow Conveyors carrying Westinghouse Lamps through various processes of manufacture and thence to storage or shipment.

IN practically every phase of daily work and play, modern civilization enlists the aid of a Westinghouse product for greater efficiency and enjoyment. And the use of Dow Conveyors by Westinghouse reflects the highly developed program of economy that has made the mystic powers of electricity, through manifold channels of service, easily available to rich and poor alike. Dow Conveyors can reduce *your* production costs and widen *your* markets. *Ask our nearest office.*

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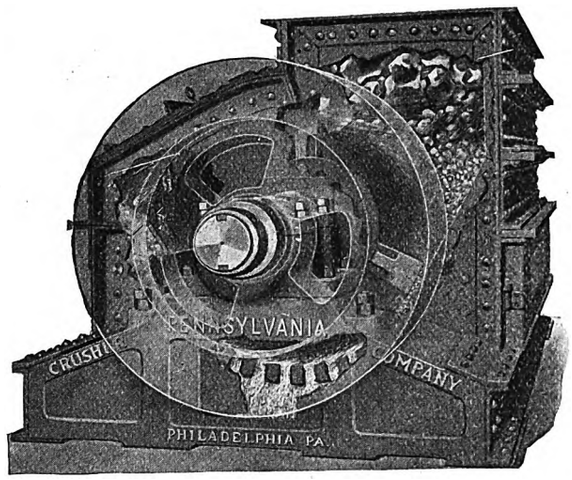
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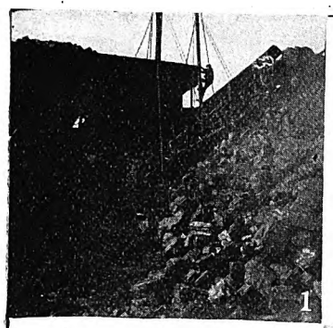
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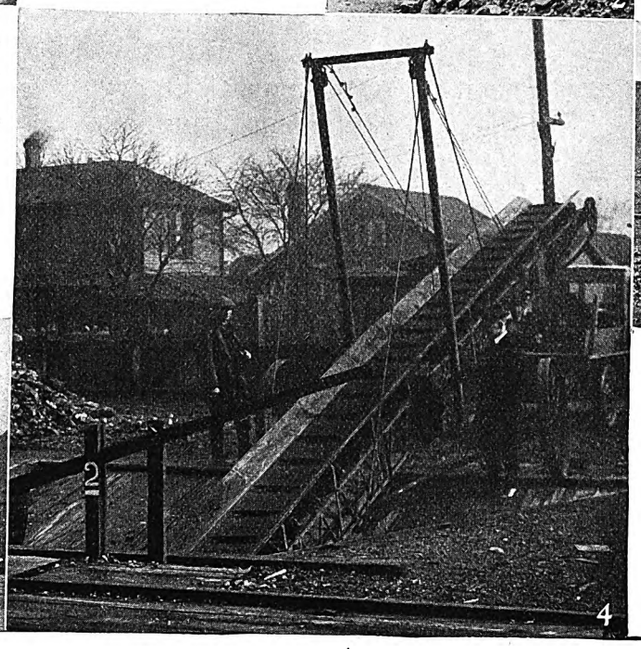
1—A Barber-Greene Conveyor, with cleated belt, handles lump coal at the J. S. Davis Coal Co., Toledo, Ohio, storing it well back from the tracks. It unloads a car of mine run in an hour.



2—Before the Miamisburg Light, Heat & Power Co. bought this Barber-Greene, there was demurrage on one or two cars out of every three received. There has been no demurrage since.

3—A Barber-Greene Conveyor stores coal at the Miamisburg Paper Co., two conveyors being used to reclaim to a bucket elevator. A car is unloaded in one hour.







4—The Barber-Greene which unloads a 50-ton car of Shamrock 4-inch lump in 59 minutes. It has eliminated storage bins near the tracks, and has increased the storage capacity of a limited area.

5—Showing Barber-Greene equipment in use at a large plant. Cars are unloaded to the conveyor, which stores at the rate of a car an hour. A Barber-Greene Loader reclaims the coal.

Stopping demurrage with Barber-Greenes

Unloading a 50-ton car of 4-inch lump in 59 minutes, a Barber-Greene Conveyor has solved more than one problem for Grove & Weber, Inc., of Miamisburg, Ohio.

It has done away with all demurrage, and eliminated a large "floating gang" of workmen. The storage bins which were formerly required near the tracks, have been discarded. The Barber-Greene conveys the coal well back, greatly increasing the storage capacity of a limited ground area.

For every three carloads of coal delivered to the Miamisburg Light, Heat & Power Company, there was demurrage on one, and often two cars. Unloading and storing a car in an hour, a single Barber-Greene has eliminated this demurrage.

Storing and reclaiming are now done by the boiler room force of two men.

At the J. S. Davis Coal Company of Dayton, Ohio, Barber-Greenes are preventing demurrage which had amounted to $600 to $800 each year. Photograph No. 1 shows how one of these conveyors, with cleated belt, handles lump coal, storing it back away from the track.

This type of conveyor, 24 inches x 45 or 60 feet, can store more than a drag conveyor, which is not built in such lengths. It multiplies the storage capacity of ground areas. With one man, it unloads a car of mine run in one hour. Send for our E Catalog, and data showing how Barber-Greenes will increase the speed and efficiency of your operations.

Barber-Greene Company, 500 W. Park Ave., Aurora, Illinois

Representatives in thirty-three cities

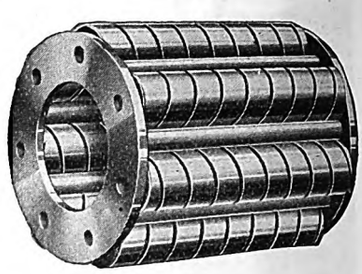
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Portable Belt Conveyors — Self Feeding Bucket Loaders

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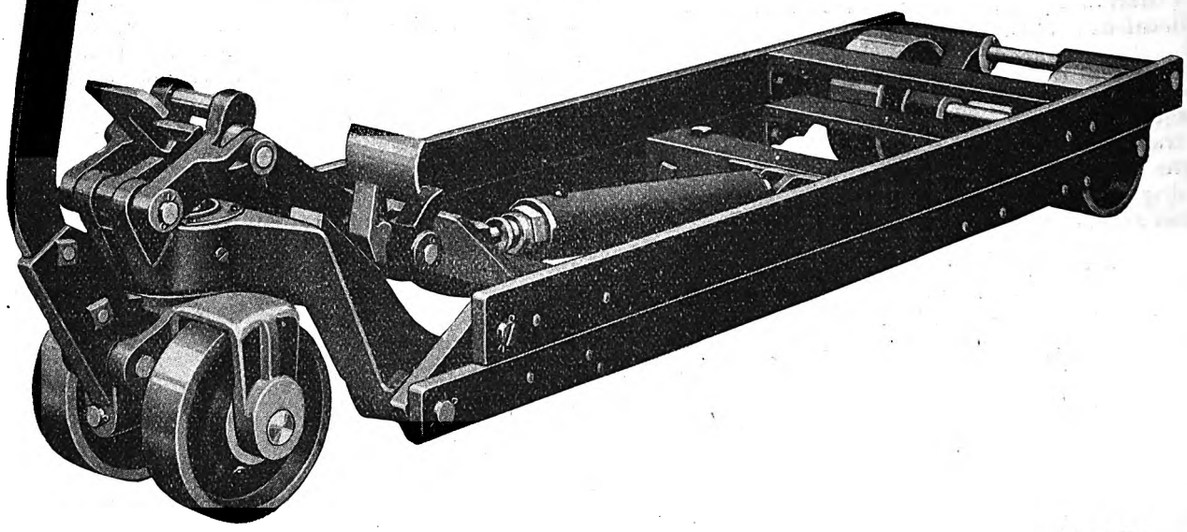


The building of quality lift trucks by the Stuebing Truck Company of Cincinnati, O., has provided an opportunity to use the best materials and parts obtainable for the service under which such trucks must operate for long term duty.

Loads transported may range from feather pillows to pig iron and the trucks must always be easy to pull. The Hyatt roller bearing equipped wheels of these trucks roll easily and smoothly across floors and speed delivery of the load at its destination, whether that be a few feet or many.

The same reliable, easy rolling Hyatt equipped wheels are standard on the new Model "U" side lift truck now produced by Stuebing, as an insurance against hard pulling and against breakdowns from bearing failures.

Specify Hyatt bearings in trucks and other material handling equipment for quick, dependable and economical transportation in your plant.



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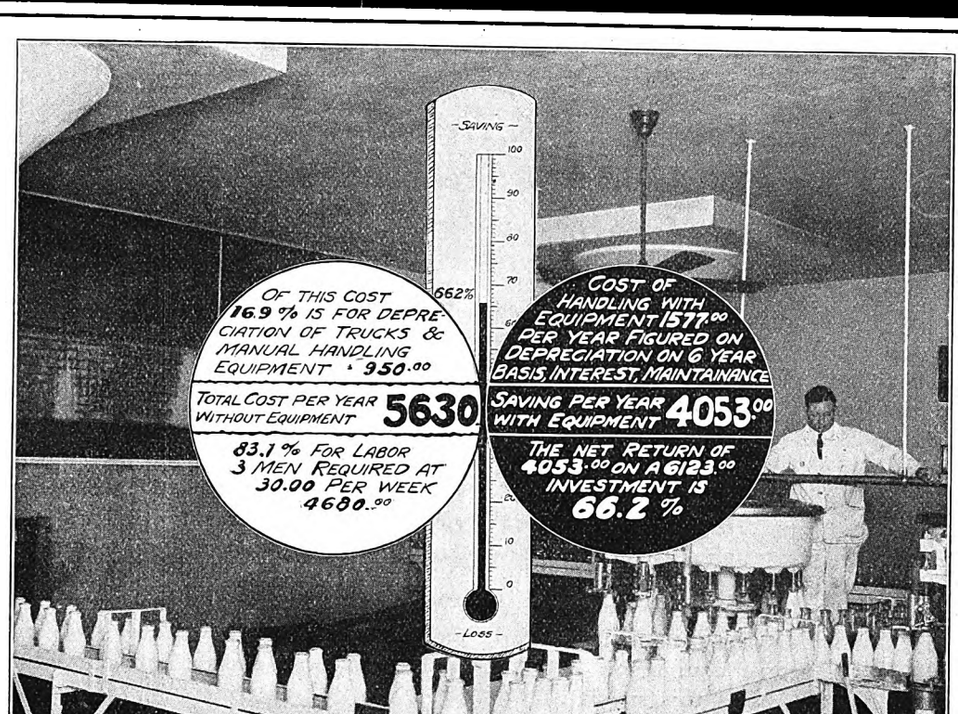
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This is what an investment in Standard Roller Conveyors and an Inclined Elevator costing $6123 earned in one year for the Franklin Co-operative Creamery Company, Minneapolis.

By the Old Way, the handling of a case of milk cost 62 hundredths of a cent—the New Way only 17 hundredths of a cent.

The Graph shows what the handling of 900,000 cases would cost them in 1920 or before they installed the equipment—and the present cost of handling this quantity.

This is a striking example of how a small saving of only a fraction of a cent mounts up into a tidy sum at the end of a year.

What is true in this business is equally applicable in nearly every industry where merchandise is handled.

Our booklets show how Standard Conveyors work for various industries. Booklet "S-4" sent on request. Our nearest conveying engineer will be glad to call and help you find out whether Standard Conveyors will prove profitable in your business.

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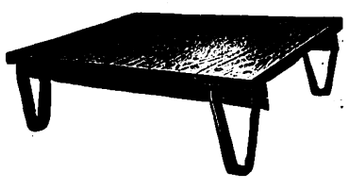
Try it. Many progressive men who are working with the interest of their Company at heart, continue year by year along a definite path with their attention focused on specific phases, and allow opportunity after opportunity to make savings (stop losses) to go by, simply because they have not asked themselves the following question—"CAN'T I IN SOME WAY CUT DOWN THE EXPENSE OF HANDLING, REHANDLING AND RE-HANDLING MY MATERIALS?" The answer is so evident that the tendency is to simply do any one of a number of things; such as buy this, or buy that; or try out this, or that. Carry this SELF ANALYSIS further and ask yourself—"DO I WANT THE GREATEST POSSIBLE SAVING?" The answer is "Yes." Right here we believe you will agree with us in diagnosing a physical ailment, you consult a diagnostician and get the best specialist you can find to prescribe the remedy.

Your MAN-REHANDLINGS can be reduced. COWAN TRUCK COMPANY can diagnose your material handling problem and supply the specialist who can cooperate with your own men in recommending a cure and supplying the proper equipment. COWAN prices not only cover the best product of its kind built, but include the services of this specialist.

The platform lift truck idea offers to you the greatest possible economies provided COWAN platforms and COWAN lift trucks are properly applied.

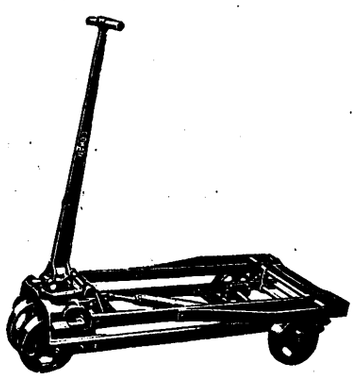
The COWAN TRUCK COMPANY offers you the most economical equipment you can purchase, not always in price, but in the thing you really pay for—results.

COWAN Long Life Skids have built into them long life, low maintenance and the ability to stand up. These features are accomplished through the use of certified malleable iron feet, riveted to the side flanges of Commercial angle iron and bolted through the top flanges of this angle to the best grade of wood decking. Oversized flat headed bolts are used and decking is countersunk so top surface is flush.

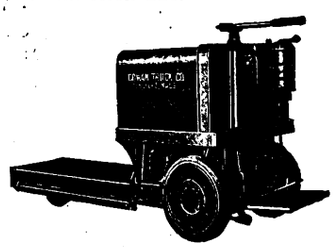


COWAN Type G Hand Lifting Machines (trucks) have personality and are superior due to COWAN'S patented lifting mechanism.

The study of our customers' problems has actuated the careful thought put into the design and workmanship of COWAN trucks and is the reason why COWAN is the largest manufacturer of Hand and Electric Lift Trucks in the world.



COWAN Model LLT Electric Elevating Machines (TRUCKS) have by actual test super qualities such as simplicity, strength, flexibility, ease of control. Many of the difficulties that have been experienced in electric industrial truck design have been eliminated in this new COWAN Model LLT.

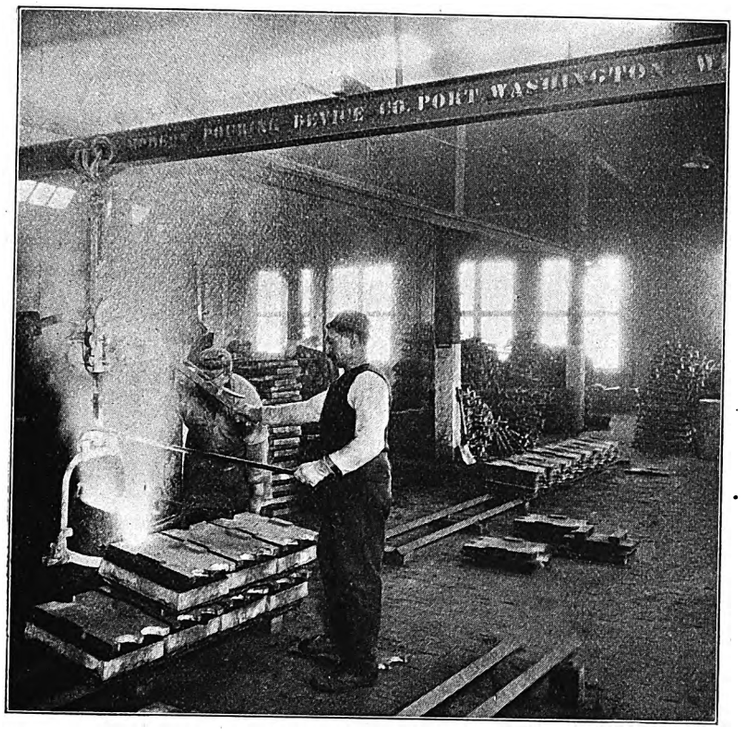


25 COWAN Long Life Skid Platforms and one Hand or electric elevating machine gives you the equivalent of 25 ordinary platform trucks. Not only is the initial cost less, but the maintenance is reduced because of the superiority of COWAN and the fact that the number of moving parts has been cut practically to 1-25th.

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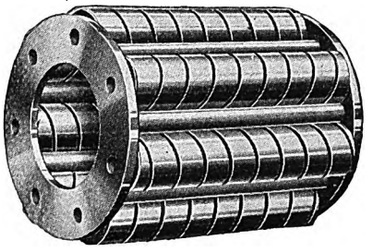
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No hitch, no confusion, the pouring proceeds smoothly and orderly from flask to flask, all easily controlled by one man.

The advantages of Hyatt bearing trolleys last throughout the life of the equipment as the bearings are durable and need no attention except oiling 3 or 4 times a year.



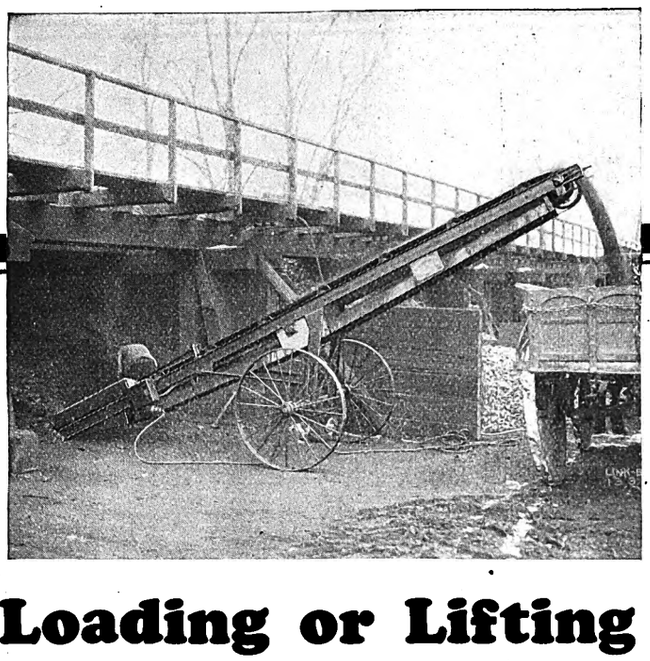
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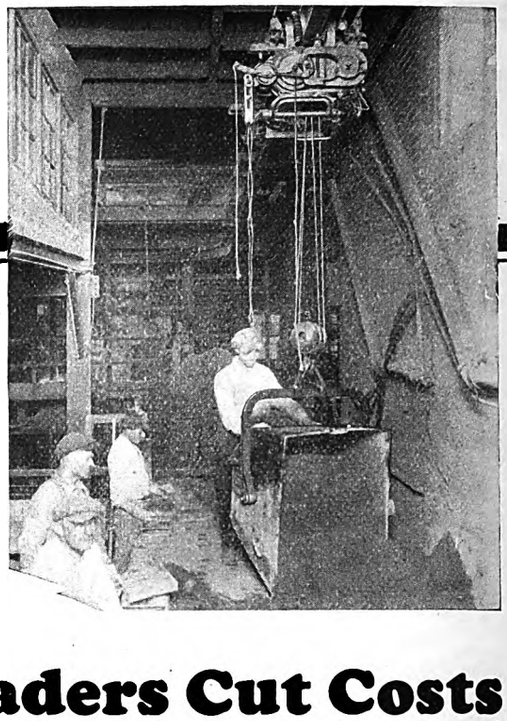
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A sturdy compact machine that will load your material faster than six men. Use it on coal, sand, stone, gravel, fertilizer, foundry refuse, etc. And load from ground to wagons, trucks and cars at one-sixth the wage cost of hand methods —every day.

Price $485, Complete

F. O. B. Chicago or Philadelphia.

Ready to work when you get it—fully equipped. While we can furnish any type of motor or gasoline engine to suit local conditions, our standard "Cub" Loader, selling at the new low price, is equipped with—

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Utilize the overhead space in your plant. Use it to convey materials to and from machines and benches, from department to department, indoors and out. Thus not only can you make that space pay for itself but you can facilitate your handling as well. An overhead system can go anywhere—obstructions, aisles, driveways, etc. make no difference, cause no delays. And handling confusion is entirely eliminated. Lasting, daily economies result.

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Link-Belt hoists are made in many sizes. Type C-½ is the smallest. It will hoist 50, 100, 500 or 1,000 pounds, do it quickly and with the minimum necessary labor. Simple construction. Working parts easily accessible. Maximum safety. Anyone can operate it. Does the work of many men. Handy cost-cutting equipment in any plant. And only $270, f. o. b. Chicago or Philadelphia.

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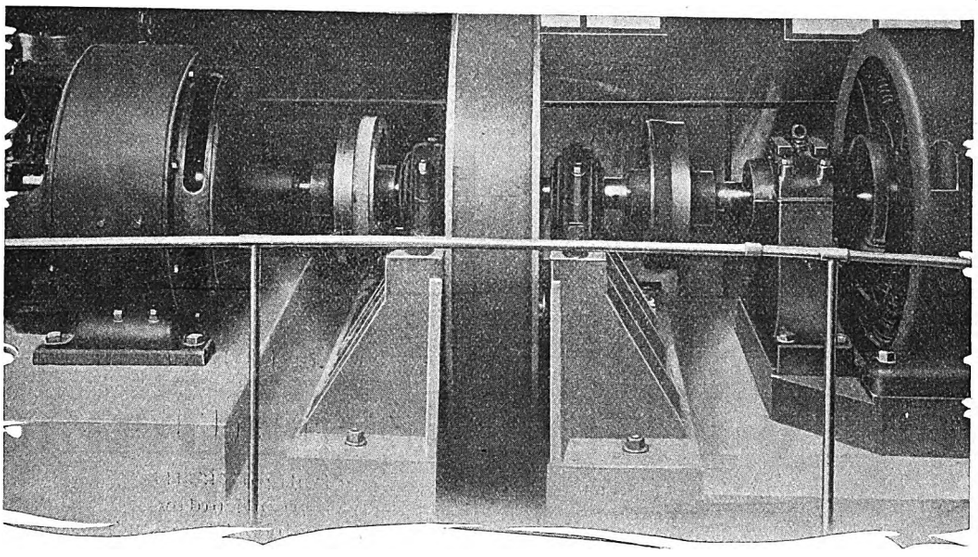
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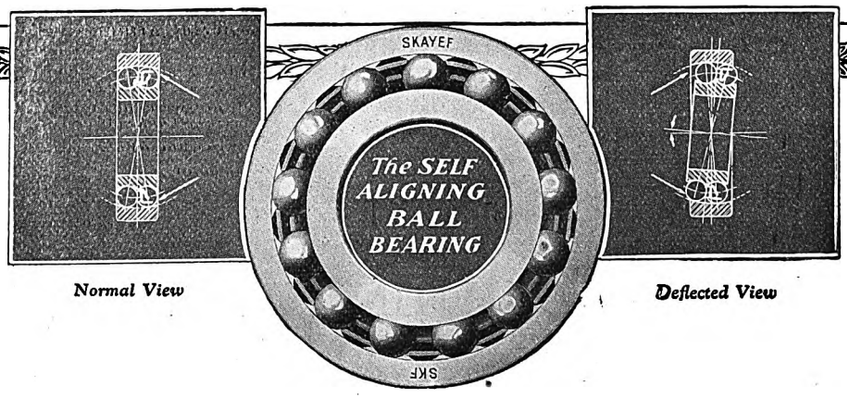
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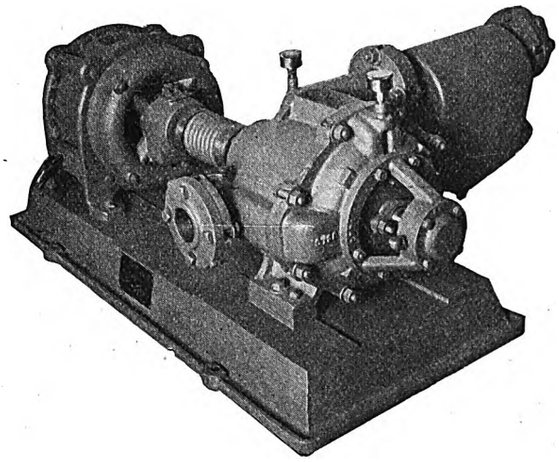
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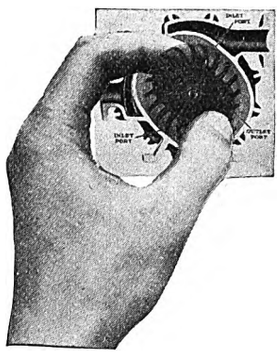
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The Pictorial Presentation of Management Science

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Editorial

The Lever that Moves the World

NOT many centuries ago, the larger part of our world was unknown and uncharted. Then came the age of exploration, when bold men started on hazardous journeys, little knowing how or where they would end. The strange lands which these pioneers discovered were looked upon, by themselves and their fellow countrymen, as "new worlds"—the natives of these strange lands as "new peoples."

But they were not new, except to their finders. Columbus did not reveal a new world, he discovered an old one that had existed since before the days of Abraham. The ultra modern island of Manhattan—minus its skyscrapers and hurrying footsteps—had its being when Adam was young. The big geographical changes were completed before man's time. Since man's time, continents, islands, mountains and rivers—"old as the hills"—have patiently, through centuries of time, awaited man's coming—awaited not merely savage man's coming but the coming of intellectual man with his ability to utilize them.

There is nothing new under the sun.

Everything that we have today and everything that we shall have tomorrow has had potential existence since the beginning of the world. The motor car was present in the Garden of Eden. Adam did not see it, for it was invisible to his intellectual vision. It was there, nevertheless, hidden in the bosom of the earth, in the iron ore, in the sand and limestone, in the rubber trees. The aeroplane was there, as was the electric motor, the steam turbine and the radio. All of the miracles of modern science and invention were there in the form of the fewer than one hundred chemical elements whose combinations comprise and form the world, the life and the tools of mankind. All of the fruits of science and invention were there but all awaited the growth of human intelligence and intellectual vision sufficient to make them visible.

It may be that if Adam had not eaten of the famous apple, mankind might have blossomed in its youth into full intellectual maturity and been blessed with such omnipotent vision, as to summon instantly all of the wonderful things which have been bought since at the expense of so much pain and toil. As it is, we are still far from intellectual maturity. Our knowledge is dearly bought. Our discoveries are painfully slow. It has taken us thousands of years to find the steam engine. It may take us thousands of years more before we discover in nature's storehouse the apparatus which is awaiting us there and which will enable us to utilize directly the power of the sun.

Mankind still resembles children playing in a great house in which are many mysterious locked doors. At intervals a child finds a key which unlocks one of the doors and reveals a new and entrancing toy. The child's delight is like that of the inventor who has discovered a mechanism new to him and his fellow men. But the toy was there all the time, and the newly discovered mechanism is not *new*. Both awaited the finding of the proper keys.

The keys to these hidden doors are *ideas*. Ideas are the keys that unlock the doors of progress, the levers that move the world. Somewhere there is a door for *you* to unlock, behind which lies success, recognition and progress. But before you find it you will have to pick up and try many, many keys.

Every picture in this publication contains an *idea*—a key to some hidden door. The keys are not all new—perhaps you have tried many of them. But do not fail to search for the one that you have not tried. Perhaps it may be the key to your treasure house!

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Pioneers of Power

The Men Who Made Modern Industry Possible

By James T. Beard, 2nd

IF we could look back through the centuries to the beginning of the Christian Era, and before, and see the activities, commercial and industrial, as they were carried on in those ancient and bygone days, we would behold massive structures and gigantic engineering feats performed, which we marvel at even today. And, if we looked further to see what mechanical or other power assisted those ancients in the conduct of their wonderful operations, we might see a motley array of oxen, camels, ropes, pulleys, levers of all sorts; man power, animal power, and a few simple mechanical contraptions for the application of such power to best advantage.

Likewise delving into the writing of those former days of the past, we can find no mention of the development of power, as we know it, by means of the pressure or energy in vapors or gases. With the exception of a few mechanical toys, the possibilities of engines in the performance of useful work were still undiscovered.

And as we look toward modern times, with our large condensing steam engines, gigantic turbines and ponderous boilers, we realize that all this development, this harnessing of heat energy derived from the earth, is a product of comparatively recent times.

The principles, however, upon which our modern prime movers are designed were more or less known to those early scholars, long before their practical application to the development of power was accomplished. This is particularly true of many of the basic properties of steam. The development and use of steam for industrial power purposes, therefore, has a long and interesting history.

Steam power, as it is known today, is the result of the composite efforts and inventive genius of many brilliant minds, reaching back through the centuries and having its beginnings considerably before the Christian Era. Just when the principle of the expansive force in steam was first discov-



Fig. 1. James Watt foresaw the possibilities of steam operated engines more than one hundred and fifty years ago. We are indebted to Watt for starting us in the right direction and to his energy and inventive genius for the impetus which he gave to the progress and development of the primitive steam engines of his day.

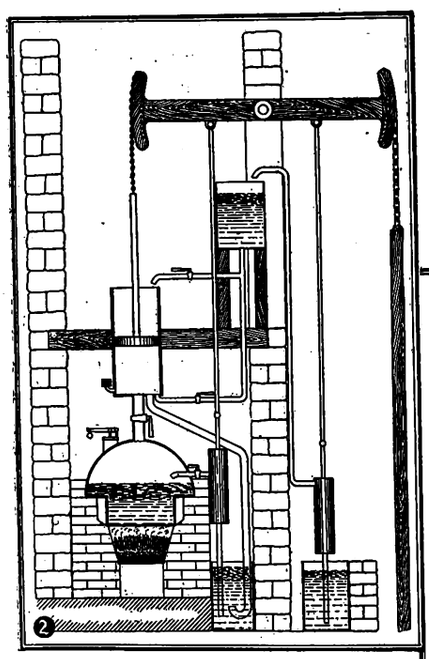


Fig. 2. The original Newcomen engine was used in Watt's time for pumping water out of the mines at Cornwall. Steam entered the cylinder at the bottom and forced the piston upward. The supply was then shut off and water was turned into the cylinder to condense the steam. The partial vacuum formed sucked the piston back to its original position.

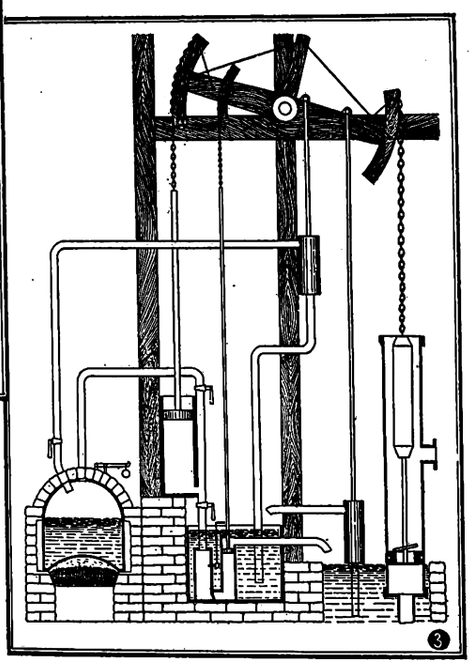


Fig. 3. Watt realized the wastefulness of alternately heating and cooling the engine cylinder and designed an early engine in which he provided a separate chamber for condensing the steam. Watt's improved engine gradually replaced the old Newcomen engine at the Cornwall mines.



Fig. 4. George H. Corliss set another landmark in the history of progress in steam engineering when he invented and applied his famous valve gear to the steam engine of his day. His invention was the first practical step toward governing an engine by adjusting the cut-off.

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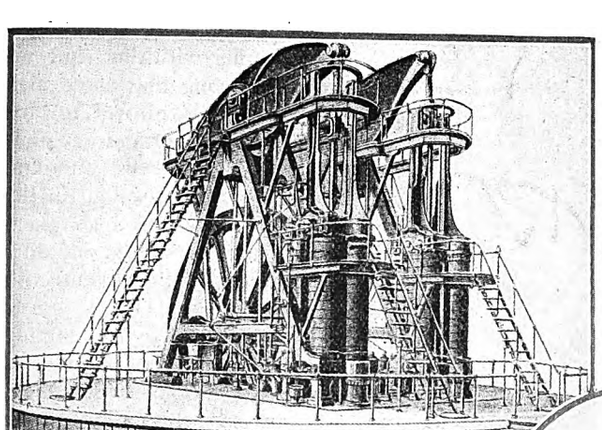


Fig. 5. At the American Centennial Exposition in 1876, Mr. Corliss exhibited his now famous Corliss Centennial Engine. This was a 1,400 horsepower unit and was considered the marvel of the day.

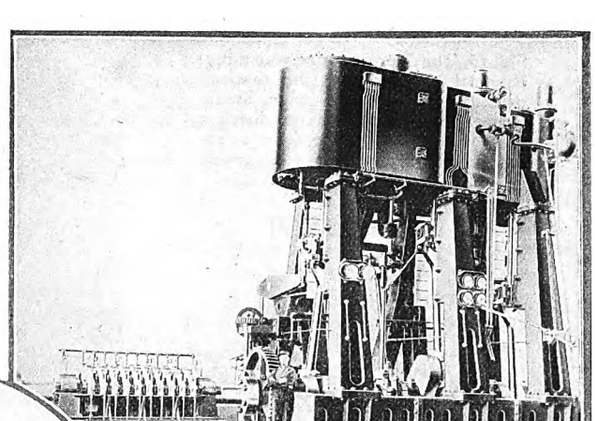


Fig. 6. The Corliss engine today is recognized as a most efficient prime mover and is found in many industrial power plants. The vertical unit shown here is a marine type of Corliss engine, in which service it has also proved its worth and adaptability.

ered, no one can say. Records show that such knowledge existed earlier than 150 B. C. A treatise written by Hero, of Alexander, describes earlier and contemporary devices for employing the expansive force of steam for the purpose of raising water from one level to another. He describes, among others, a device which we known as the Hero turbine. This consisted of a vessel for evaporating water, upon which was mounted a rotating drum, provided with spouts on opposite sides for the release of the steam generated. The steam issuing from these spouts produced a "kick" that caused the drum to revolve. In this mechanical toy the principle of the present day reaction turbine was first employed. But it was just a toy and was never put to any practical commercial use until nearly two thousand years later.

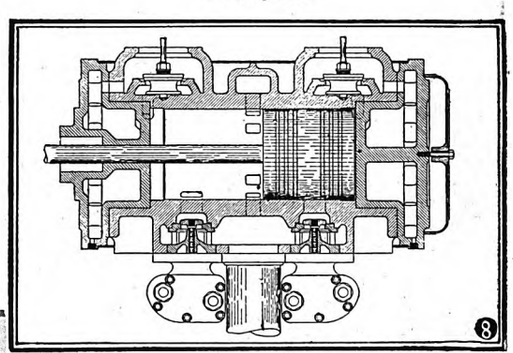
It is not the purpose of this article to point out each step in the path of progress and development in the steam engineering field from the Hero turbine to the present day. To do so would require volumes. All we can hope to do here is to indicate the high spots and to point out one or two of the outstanding characters who were responsible for basic and fundamental developments in the principal branches of steam engineering, as we know it.

Although the knowledge of the expansive force of steam existed more than two thousand years ago, there was no material progress in the practical application of that principle to mechanical devices for the purpose of doing useful work until the late six-



Fig. 7. Prof. Johann Stumpf is one of the outstanding figures in the steam engineering field today. In his uniflow engine he has applied the principle of uni-directional flow and has thereby practically eliminated condensation losses in the cylinder due to alternate heating and cooling by live and exhaust steam.

Fig. 8. The uniflow engine cylinder is longer than the cylinder of a counter-flow engine. Steam is admitted at either end and during expansion flows to the mid-point of the cylinder, where it exhausts when the piston uncovers the exhaust ports.



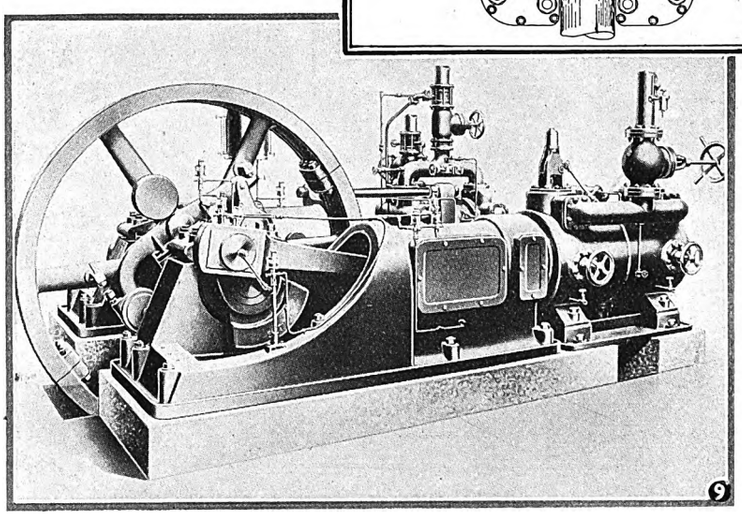


Fig. 9. The uniflow engine is not much different in appearance from the counter-flow engine, with the exception of its elongated cylinder. The illustration shows a uniflow poppet valve steam engine direct connected to a horizontal double acting compressor.

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Fig. 10. The Hero turbine was a mechanical toy, utilizing the reaction principle for causing rotation. Steam issuing from the spouts produced a "kick" which caused the drum to revolve. This device was described by Hero as early as 150 B. C.





Fig. 11. Sir Charles A. Parsons was one of the outstanding figures of importance in the development of the reaction steam turbine as we know it today. Although his activities were carried on in England, these turbines are now in wide use in this country and are especially economical in large sizes and high speeds.

Fig. 12. The early types of Parsons' reaction turbines installed in this country are typified by the Westinghouse steam turbine generator units, installed in 1898 at the Westinghouse Air Brake Company.

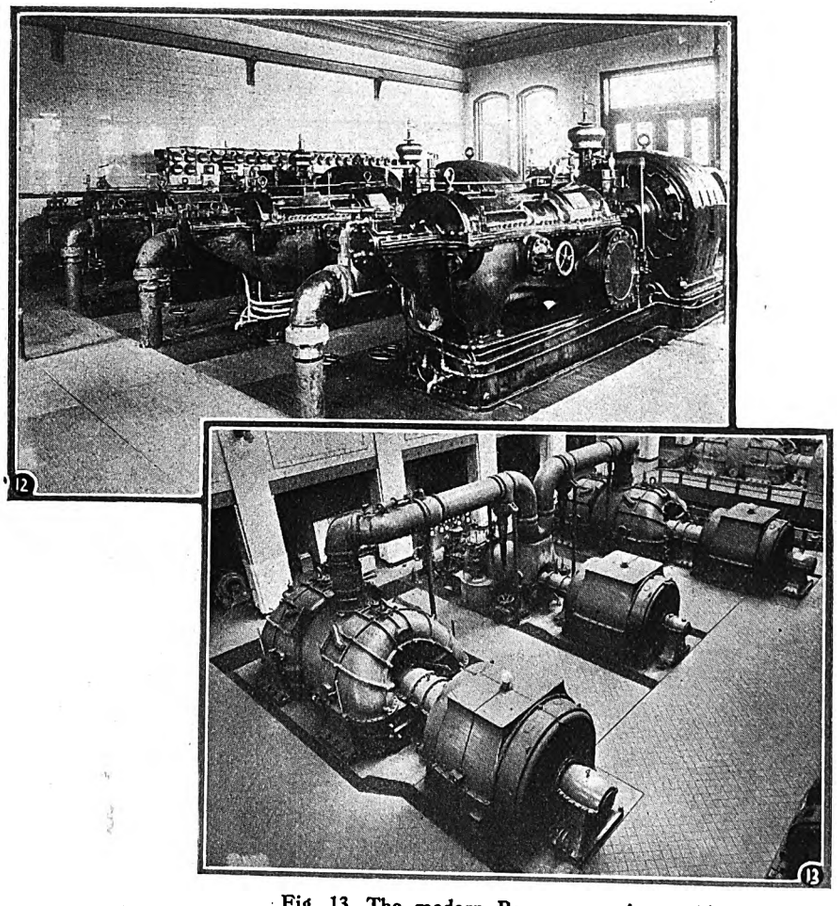


Fig. 13. The modern Parsons reaction turbine is a very efficient generating machine. The illustration shows a 72,500 kva. compound unit installed at the Duquesne Light Company, Cheswich, Pa.

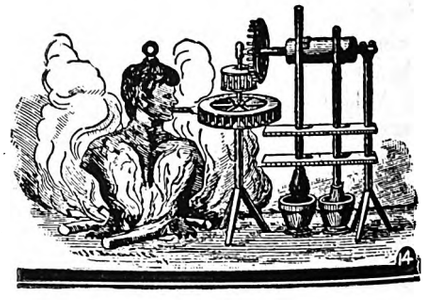
teenth and early seventeenth centuries. Beginning with that time we find records showing that some men were devoting their efforts toward producing steam operated engines which were capable of pumping water. These efforts resulted in the eventual development of a commercially successful pumping engine during the latter part of the seventeenth century.

The outstanding figure among these early inventors, of course, is James Watt. Previous to his time, the best type of engine was the famous Newcomen engine, which was used for pumping water out of the mines at Cornwall, England. This engine was a very crude, slow-working contraption. It operated on a steam pressure only slightly above atmosphere. Steam was admitted to the bottom of a single-acting vertical cylinder, forcing the piston upward. When the piston reached the top, the steam was shut off and cold water was turned into the cylinder. This cooling action condensed the steam in the cylinder and formed a partial vacuum, which sucked the piston downward again to the bottom of its stroke. The cycle was then repeated.

Watt was called upon to repair this engine in 1764 and became interested in it because of many of its shortcomings. He was convinced that an excessive amount of steam was being lost by the alternate heating and cooling of the cylinder and his first attempt at improvement consisted of the use of a separate chamber for the condensing of the steam.

In the course of his experiments he developed the "double-acting" principle in a steam engine, *i. e.,* steam was admitted alternately to each end of the cylinder. This eliminated the

Fig. 14. The Branca turbine, known in the seventeenth century in the form of a mechanical toy, is the first instance of using the impulse principle to produce rotation or rotary motion. The step between this and the present-day impulse turbine is tremendous and has taken nearly 400 years to realize.



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Fig. 15. Charles Gordon Curtis was an American. He studied at Columbia University and later became interested in the possibilities of the impulse principle as applied to steam turbines. Curtis turbines today have a wide distribution both in central stations and industrial plants of the United States.

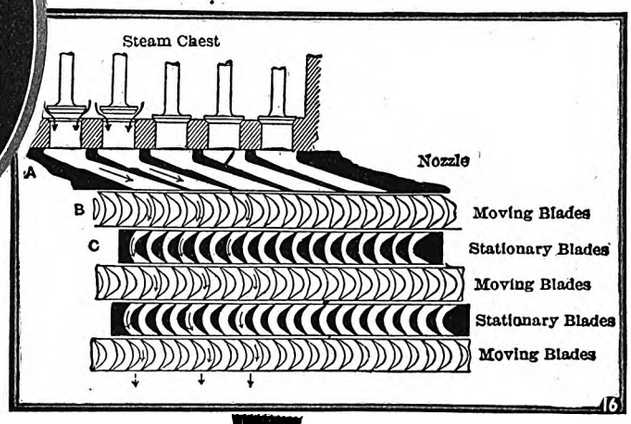


Fig. 16. Steam is admitted to a turbine through suitable nozzles, and imparts its energy successively to a series of moving blades mounted upon a revolving drum. Between each two rows of moving blades are stationary blades for the purpose of reversing the direction of steam flow before it passes to the next series of blades.

time required before the engine could make a return stroke and increased the speed of the engine.

Watt must have been a genius. His originality of conception, as shown by the long list of radical improvements credited to him, is little short of marvelous. Ideas developed by him are embodied in our modern engines today.

His greatest accomplishment was undoubtedly the practical application of the expansive force of steam to a steam engine. Previous types of engines had used steam at full pressure during the entire stroke. Watt conceived the idea of cutting off the steam supply at a fraction of the stroke and allowing it to push the piston forward the rest of the stroke by its expansion.

Previous to the successful application of this idea, however, he found it necessary to equip his engine with a flywheel so that the energy stored in the wheel during the first part of the stroke would keep the engine speed fairly constant the rest of the stroke. To do this he invented the crank and connecting rod for converting rectilinear motion into circular motion.

Watt's inventions pointed the way to the possibilities that lay in the steam engine as an economical prime mover. Under his supervision it had graduated from the steam pump

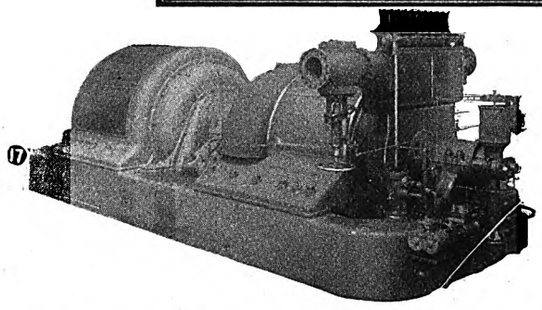


Fig. 17. A modern 7,500 kw., 2,300-volt Curtis turbine, designed for a speed of 1,800 r.p.m.



Fig. 18. William Le Roy Emmet, whose recent successful operation of an experimental mercury boiler plant of his own design at the Hartford Electric Light Company has indicated possibilities of much higher steam economy than has heretofore been possible.

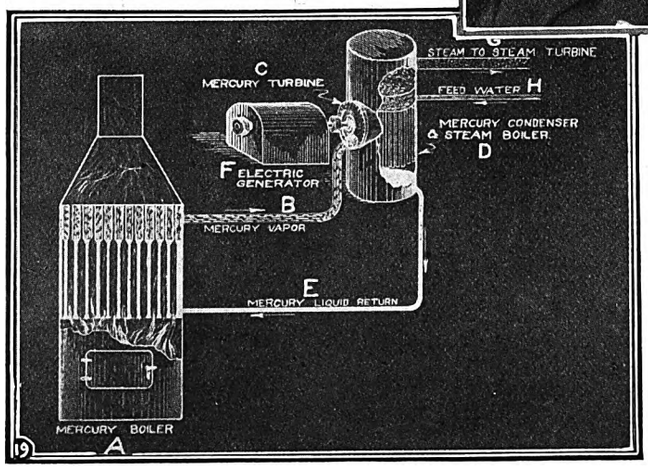


Fig. 19. Diagrammatic sketch of mercury boiler installations. Mercury vapor under pressure is generated in a special boiler and is used to develop power in a specially designed turbine. The exhaust vapor from the turbine is used to generate steam in a second boiler, giving up its heat and condensing to liquid mercury, whence it flows by gravity back to the mercury boiler. The hot flue gases from the mercury boiler are used to superheat steam from the second boiler and to preheat the feed water.

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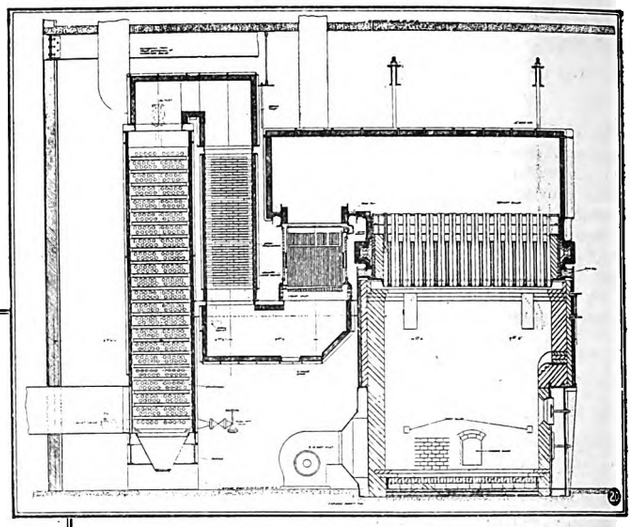


Fig. 20. Sectional view through a mercury boiler plant, showing the provisions made for preheating the mercury, evaporating the mercury, preheating the water and superheating the steam.

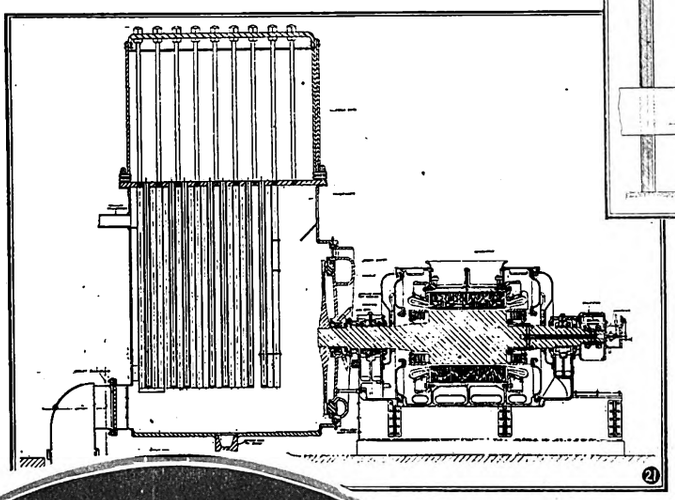


Fig. 21. Sectional view through the mercury vapor condenser (or steam boiler) and through the mercury turbine. The turbine vapor exhaust is condensed to liquid mercury and gives up its heat to evaporate the water in the boiler, or condenser.

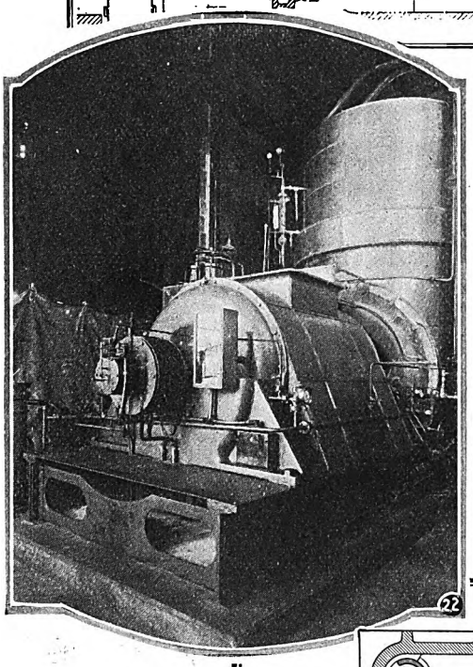


Fig. 22. The mercury boiler installation as it actually looks in real life. While still in the experimental stage, indications are that its commercial success will eventually be assured.

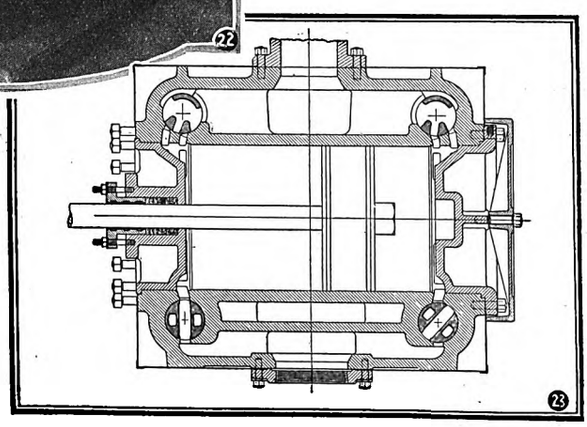


Fig. 23. Section through the cylinder of a modern Corliss engine. Note the four separate valves for controlling the admission and exhaust of steam used in the cylinder.

stage. His later inventions included a throttle valve, a centrifugal governor for controlling the speed, and a steam engine indicator for measuring the work done by the engine.

But Watt's activities, epoch-making as they were, left much to be desired. Inspired by his inventions, various types of valves were developed for automatically controlling the admission of steam to the cylinder.

It remained, however, for George H. Corliss, nearly 100 years later, to automatically govern the speed of the engine by adjusting the cutoff. This he accomplished by establishing a direct connection between the governor and the cutoff mechanism.

Corliss was undoubtedly another outstanding genius. The Corliss valve gear accomplished three fundamental and necessary improvements and foretold the possibilities of high steam economy which we have in our modern engines today. *First,* it reduced cylinder condensation by providing separate valves for inlet and exhaust steam. *Second,* it increased the thermal efficiency because the speed could be governed by adjusting the cutoff and maintaining a high initial steam pressure. *Third,* it made possible separate adjustment of inlet and exhaust valves, thereby increasing the efficiency of the engine under all load conditions.

Perfect as the Corliss engine is today, however, Prof. Johann Stumpf recognized the opportunity for still further improvement and, inspired by his activities of the present day, we have seen the development of what engineers call the "uniflow" steam engine.

It was Prof. Stumpf's idea to elim-

(*Continued on page* 73)

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"Selling" the Company to Prospective Employees

How the Western Electric Company Builds Up Its Family Spirit

By Calvin Lindley



The large reproduction here shows the "Western Electric World"; virtually a shop paper, published in paid space in a daily newspaper.

Advertising such as this not only appeals to the employee—but to his wife and family, and to other potential employees.

WHAT tale does the help-wanted advertisement tell to the worker? It should tell him much. It should awaken his desires, foster his hopes and dispel some of his fears. All this cannot be done in a single chapter. Therefore the publicity aimed to secure a better personnel sometimes becomes, through necessity, a continued story. When the need for desirable help is stated in a series it becomes apparent to the worker that the company advertising has something more in view than putting on a temporary force.

One of the most interesting newspaper advertising campaigns conducted, in which the recruiting of desirable employees was an object, was that of the Western Electric Company of Chicago. Its big appeal lay in the fact that it did not resemble a distress signal. Rather it featured the idea of permanency and that the company had a steady program of manufacturing and growth.

Another thing it was not so plainly labeled as a help-wanted campaign that it could be distinguished as such. In fact it was not that alone. It was good-will publicity that impressed the community with the bigness of the concern and also told the housewives as well how they could profit by using the appliances the company sold.

"Concerning a Neighbor of Yours" was the keynote of the campaign and aptly enough, was used as a permanent heading for the different advertisements.

Consider an early piece of copy used. It showed a picture of a paymaster and a quantity of envelopes with the caption "The 'ghost' a popular figure at the Western Electric Hawthorne Works." The display line of the Advertisement was:

HOW YOUR NEIGHBOR'S PAY-DAY HELPS CHICAGO

Twenty-eight thousand people draw pay at the Western Electric Hawthorne Works. In a week that adds up to over a million dollars.

What do they do with it? Ask the stores. Ask the theaters. Ask the real estate men. Ask the banks. While

(Continued on page 97)

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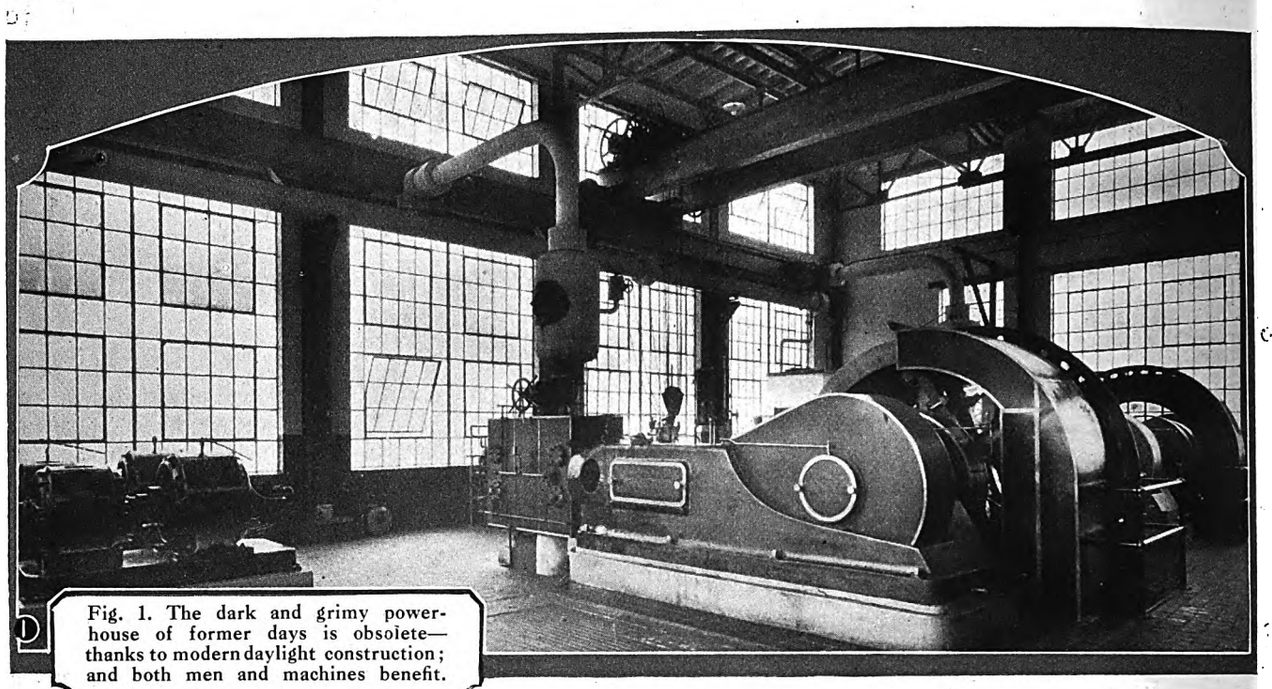


Fig. 1. The dark and grimy power-house of former days is obsolete—thanks to modern daylight construction; and both men and machines benefit.

Putting the Sun on the Payroll

How Modern Construction Provides Maximum Daylight

By Walter F. Ballinger

OF all of Nature's generous gifts to mankind perhaps the most variable in quantity and character is daylight. Science has far surpassed Nature in providing us with uniform easily regulated light.

Nevertheless natural light is counted one of the great aids to production in our modern and efficient industrial world, and our factories are reflecting in the increasing size of their windows, our growing appreciation of its desirability.

Within the past decade or two the design of industrial buildings has undergone a marked change not only in construction but also in fenestration. It was formerly the usual custom to use relatively narrow double hung, wood sash windows separated by an equal width of brick wall. Considering only the wall space between bench height and the ceiling, which is the only possible area in which windows can be effectively placed, it was common practise to have less than half of this space in glass.

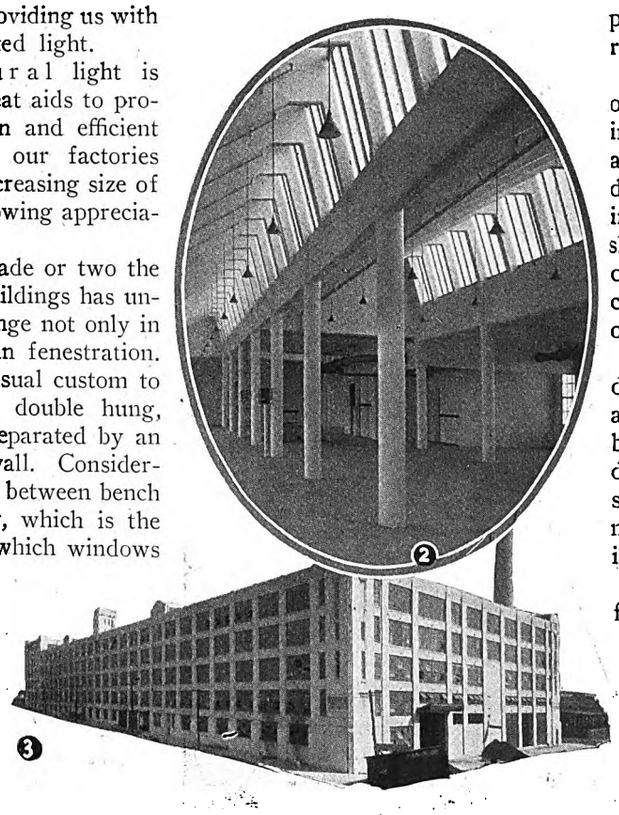


Fig. 3. A type of construction happily becoming more common; with light and ventilation as primary factors in the design.

Now it is the usual thing to have 75% to 85% of this "possible window area" in glass, and even 100% is obtainable through an ingenious improvement in factory construction recently developed.

Thus the external appearance of our factories has recorded this growing demand for more daylight. So also has the interior changed from dingy room with dark walls and ceilings and many light-obstructing belts, shafting and partitions, to bright clean open light-walled rooms that are as cheerful and pleasant as the older ones were gloomy and depressing.

Changes have also come in windows, glass, wall and ceiling finishes and all the other elements used to bring light into the factory. Before discussing these various details, we should first go back for a moment to natural light itself and consider briefly its principal characteristics.

Natural light varies in intensity from month to month, day to day and

Fig. 2. Above, in the oval, is a section of a sawtooth roofed building, with excellent light-reflecting ceilings and walls.

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hour to hour. It is totally lacking during working hours at some seasons, and it is never wholly dependable except in cloudless climates. Direct sunlight is exceedingly intense, and must be shaded from the eyes. Blue sky reflects less light than a cloudy sky. Reflected light from the north sky is the most uniform natural light in quality and quantity. These are pertinent facts to keep in mind.

Consider the average factory lighted by windows in the walls. Investigations by Messrs. Perrot and Vogan have recorded these facts: At the west windows of a building on a cloudy day just before noon they measured a light intensity of 124 foot candles four feet inside the windows. On a sunny day with a bright clear sky (the windows being in shadow) they measured only 20 foot candles in the same position at the same time of day. Thus the dull grey clouds in the first test reflected into the building over six times the light reflected by the clear blue sky of a sunny day.

At the same time they found these conditions at the east windows: On the cloudy day they measured 120 foot candles (6 feet from the glass) while on the sunny day the intensity was 428 foot candles. Thus on a cloudy day the east and west windows obtained practically the same amount of light, while on the sunny day the light varied in intensity from 20 foot candles on the shadow side to 428 foot candles on the sunny side. One side of the building was deficient in light (relatively speaking) while the other side received too much light.

Another fact was developed by these investigators. They measured the intensities of illumination at regular intervals across buildings of various widths. Plotting their readings on a chart produced a curve shaped much like a broad based letter "U," the vertical sides of the "U" representing the higher intensities found near the windows and the base of the curve representing the much lower intensities occuring in the center part of the room. In the center third of a 98 foot building they found an intensity of 2 foot candles on the bright sunny day and only 65/100 foot candles on the dull cloudy day. Hence, in spite of the unevenness of light at the windows, the bright sunlight on one side tripled the amount of light reaching the center.

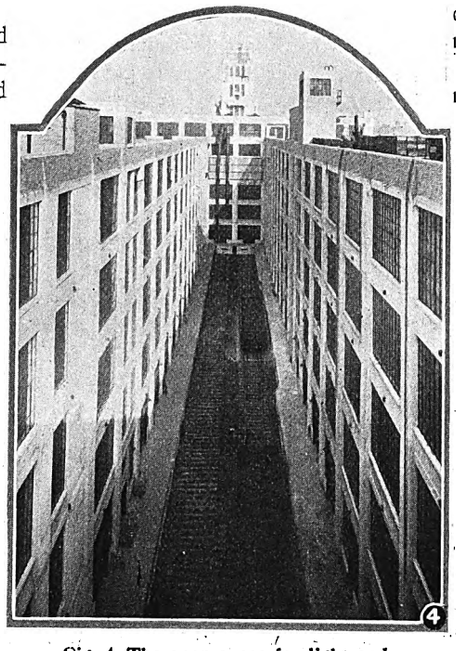


Fig. 4. The open space for light and air here is not wasted; being utilized for the railroad siding.

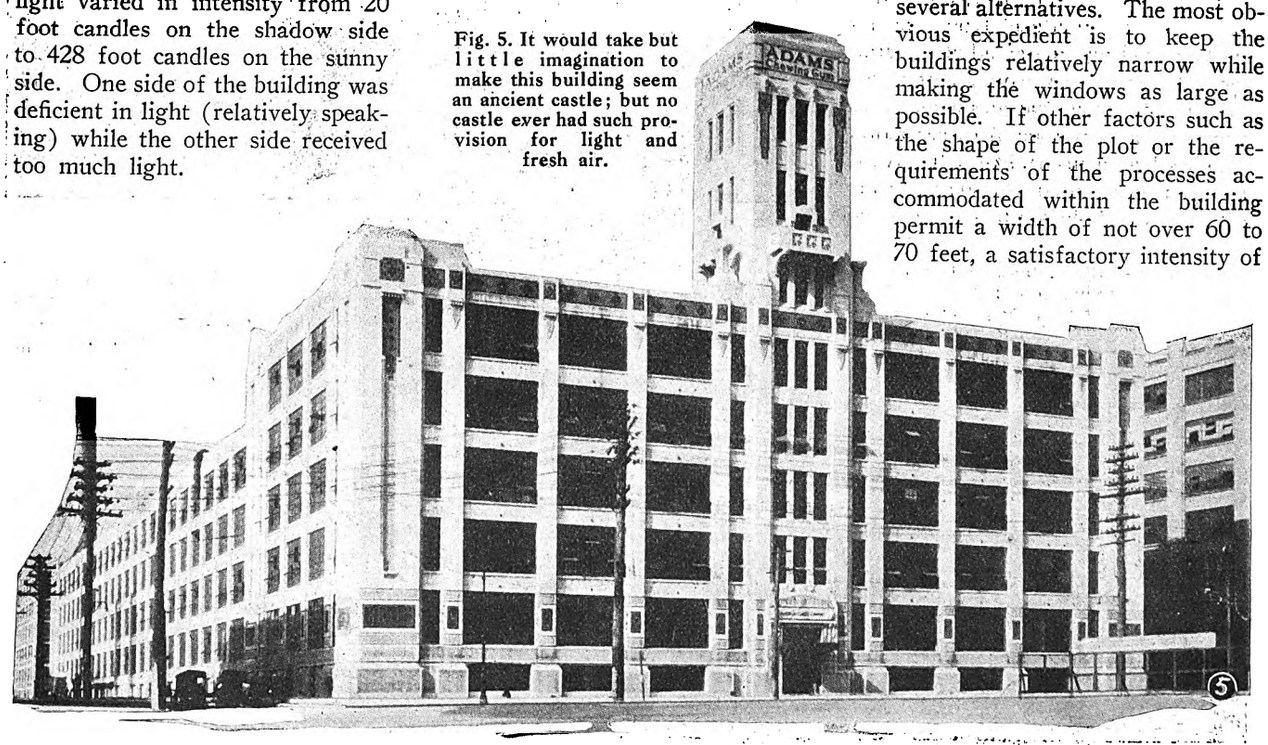
These three experiments and their results reveal the essential problems in getting daylight into the factory building. Briefly stated, the high intensity of light at the windows must be carried into the center with as little loss as possible and yet the glare of direct sunlight must be subdued.

This paradoxical situation is successfully met in several ways; by increasing the ratio of window area to floor area, by using sawtooth construction wherever possible, by using improved types of glass, and by surfacing the walls and ceilings with paints or other finishes of high reflecting power.

When a new structure is being planned, the well informed designer can secure the maximum amount of light by adopting as many of these tactics as are appropriate under the conditions of the problem.

To increase the ratio of window area to floor area the designer has several alternatives. The most obvious expedient is to keep the buildings relatively narrow while making the windows as large as possible. If other factors such as the shape of the plot or the requirements of the processes accommodated within the building permit a width of not over 60 to 70 feet, a satisfactory intensity of

Fig. 5. It would take but little imagination to make this building seem an ancient castle; but no castle ever had such provision for light and fresh air.



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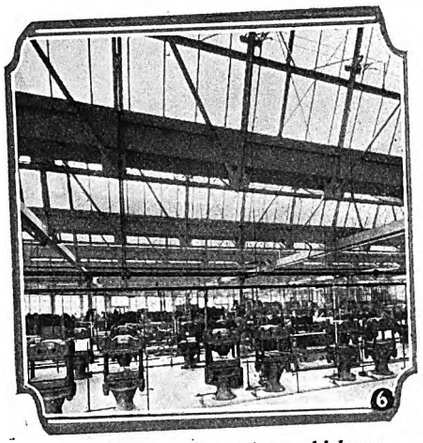


Fig. 6. Here is a plant which approaches very nearly the ideal in natural lighting; literally a case of "working in broad daylight."

illumination generally will be obtained. If a wider building is essential, and light courts or wells are not acceptable, then the ceiling heights may be increased in order to get more glass. This increases the cost of the building as well as the cost of heating and air conditioning.

The other alternative is to eliminate all interruptions to the windows, making them practically continuous from corner to corner. Recently this was actually accomplished in a flat-slab concrete factory building designed by the writer. A spinning mill 121 feet wide was constructed with normal ceiling heights and continuous glass sash, there being no structural piers in the walls, (except for pylons added for architectural effect) from one end of the building to the other. Satisfactory light was procured at the center, 60 feet from the windows.

This improved type of construction permits practically 100% of the available wall area to be of glass. This result is accomplished by carrying the floors beyond the last row of interior columns as a cantilever. The low curtain wall and the glass sash for each story are supported on the edge of the projecting floor slab. Thus the floors support the walls, instead of the walls supporting the floors. There is ample aisle space between the wall and the first row of columns. Since the columns are round and are five feet or so from the windows they cast less shadow and interrupt much less light than wall piers. It is interesting to note that this type of construction is materially less expensive than the concrete building of equal quality.

When overhead lighting is possible, as in one story buildings and in the top floor of multi-story structures, the opportunities for improving the interior lighting are greatly enlarged. There are three important ways of obtaining overhead light through the roof: by using ordinary skylights, monitors, or sawtooth skylights.

The first two, ordinary skylights and monitors, possess the same difficulties presented by windows in south, east, and west walls, namely that they admit the direct rays of the sun which often are too bright and must be subdued. When direct sunlight enters

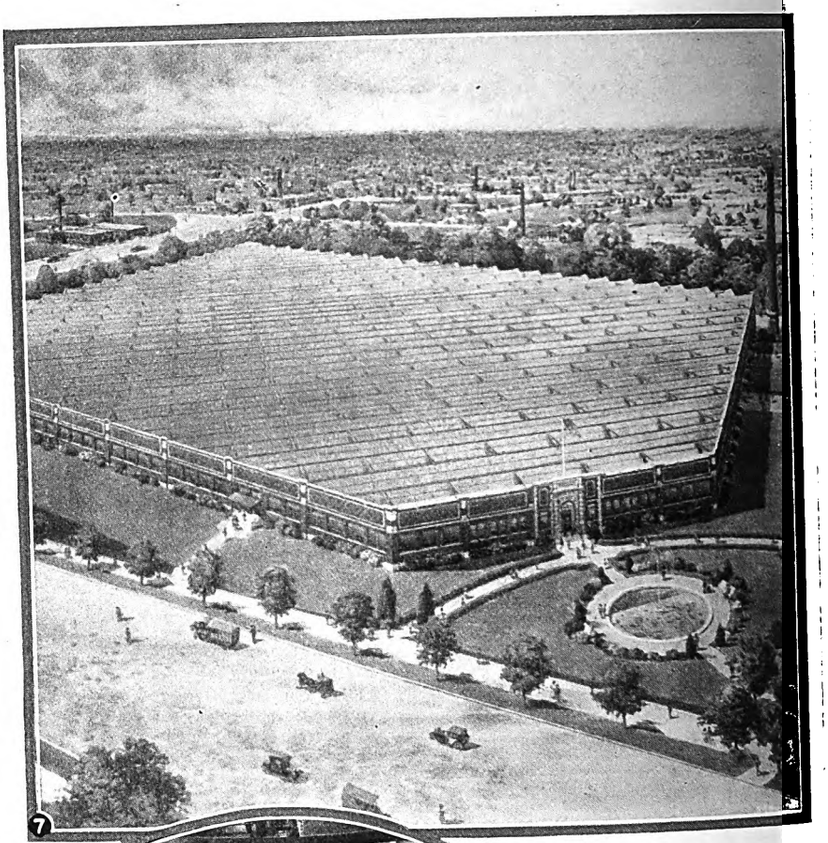


Fig. 7. An appropriate title for this illustration would be "acres of daylight." In such a structure, dark corners are unknown.

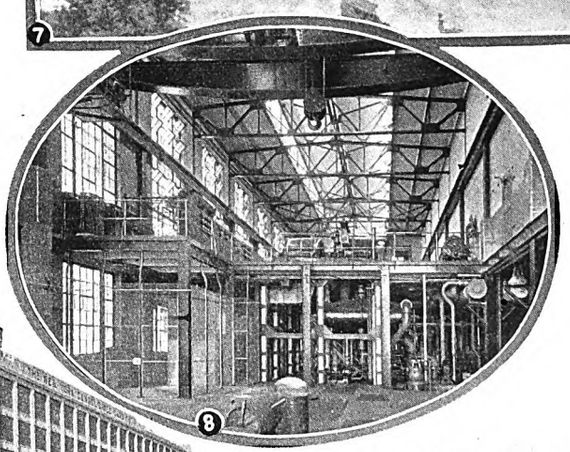


Fig. 8. Here the monitor supplements the high windows, giving better light to the far side of the building, and a more even light throughout.

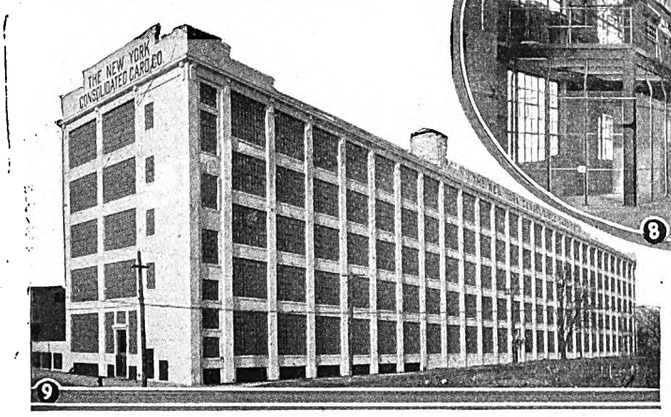


Fig. 9. High ceilings, with windows extending from bench height to ceiling, afford perhaps the commonest method of providing plenty of natural light.

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Fig. 11. The well-known Victor Talking machine plant at Camden, N. J., is an excellent example of handsome architecture combined with modern ideas of good natural lighting.



Fig. 10. Obviously, in a structure of this width, side windows could not possibly supply adequate daylight. In such cases the sawtooth roof is the solution.



through glass the sun's heat also enters, adding warmth which sometimes is undesirable, especially in summer, and at all seasons in plants that are already overheated by the processes contained within. Nevertheless, these two types of light sources have their uses, for they are inexpensive to construct and may be used for local lighting and for any situation where uniformity is not important.

For ideal natural lighting sawtooth skylights are used. They are orientated to face the north, and the slope of the glass is so arranged that direct sunlight cannot enter. As we have already indicated, reflected light from the north sky is the most uniform natural light available, hence a room illuminated wholly by skylights or windows facing the north will experience neither the glare nor heat of the sun, nor will there be sharp shadows. As an actual fact sunlight will enter a north window late in the afternoon for a short period in June in this latitude, but this need not be considered.

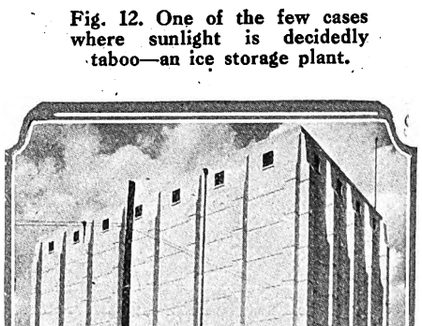
For fine machine work, for textile weaving and spinning, for assembling and for all processes requiring color matching, or careful inspection, sawtooth roofs are particularly desirable. It is customary to get an area of glass in the sawteeth equal to about 33 per cent. of the floor area. It is interesting to know that greater interior illumination results from using a smaller number of large sawtooth skylights than from a greater number of smaller sawteeth, other things being equal. This also tends to reduce the cost of construction.

Obviously sawtooth roofs permit very wide buildings where one story construction is permissible. A common objection to this construction is the fact that most sawtooth roofs require supporting columns at relatively short intervals. This difficulty may be overcome in some measure by using heavy "I" beams, eliminating one half to two thirds of the usual number of columns. A few years ago the writer developed and patented a system of trusses known as "Super-Span" sawtooth roof construction which eliminates all columns in buildings up to 100 feet in width and over 95% of the columns in larger structures. This construction is now coming into wide-spread use.

Since sawtooth skylights depend wholly upon reflected light it is well to remember that blue sky reflects less light than a cloudy sky. Thus on clear days the actual intensity of illumination may be less than on "dull" days. To overcome this in a large measure it is simply necessary to use a light colored surface on the roof slopes of the adjacent sawteeth. This reflects the direct sunlight into the skylights whereas a black or dark colored roof would absorb the light.

(*Continued on page* 78)

Fig. 12. One of the few cases where sunlight is decidedly taboo—an ice storage plant.



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Keeping the Electrical Power Equipment Fit

By William G. Ziegler

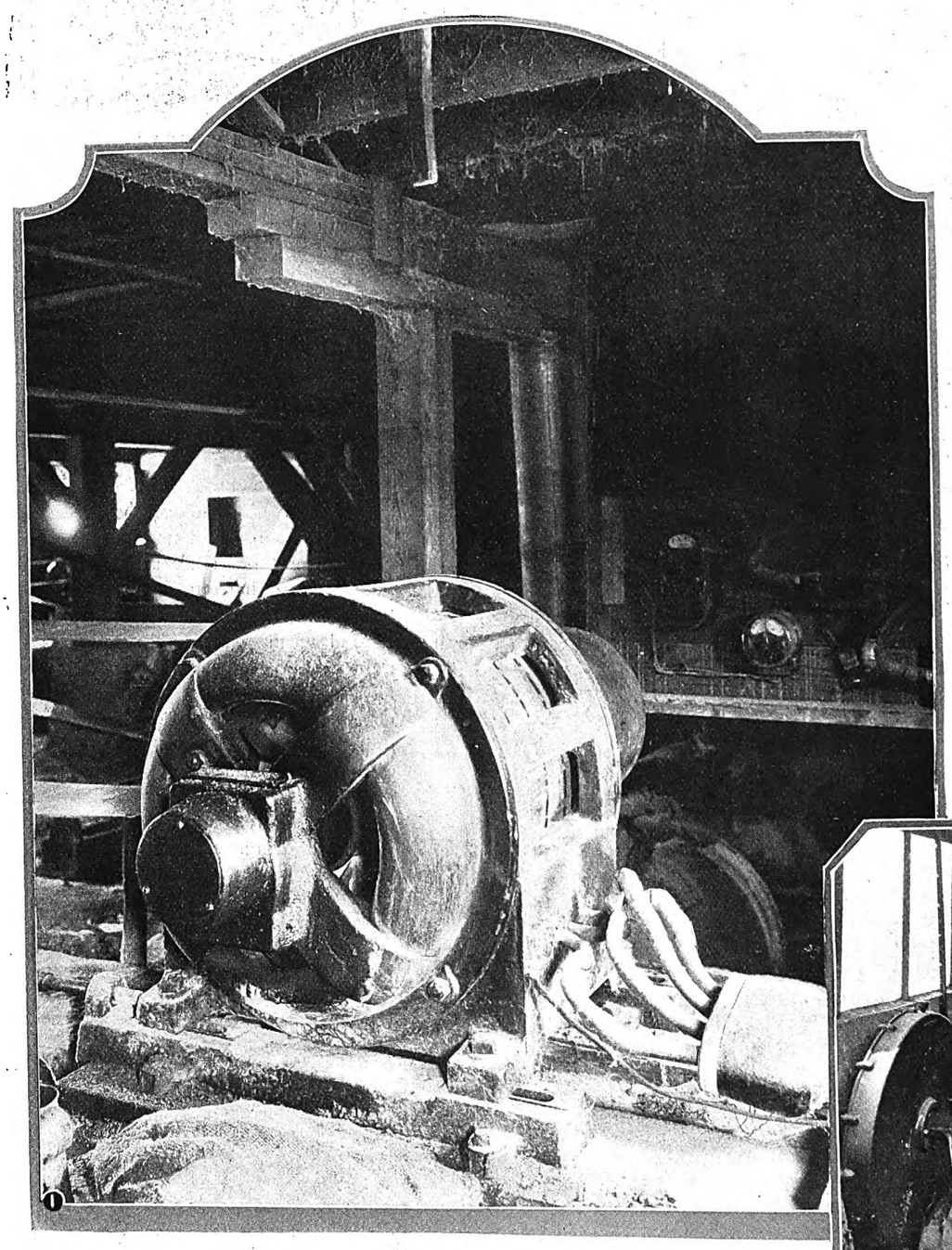


Fig. 1. One of the important items of motor maintenance is the periodic removal of dust accumulations. At least once a week the dust should be blown from the windings by means of a blower or an air gun—or, lacking these, by means of a hand bellows.

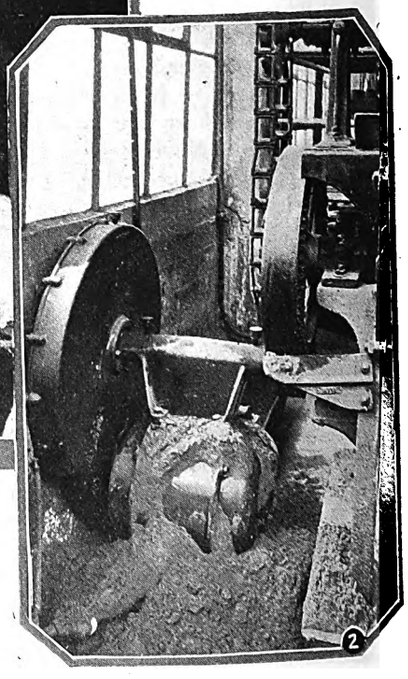


Fig. 2. This motor, operating under exceptionally severe conditions, is equipped with a ventilating system of its own; the pipe for air supply to the housing, leading to a source of dust-free air.

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THE maintenance of the electric power distribution system with its network of wiring, together with motors and other electrical equipment, is one of the most important maintenance jobs in the plant. For production is absolutely dependent on the proper functioning at all times of the motors that drive the various machines and special equipment. And back of the motors is the power distribution system with its wire and fuses and transformers, each one of them playing their part in keeping the motors running. A complete shutdown of a plant due to a short circuit on a main feeder is a rare occurrence, and it is well that it is so, because every idle minute costs hundreds of dollars, directly in pay to the men, and indirectly in overhead and loss of profits while the machines are idle. Most breakdowns are confined to one motor or to one department and are therefore not so costly, but as they are usually due to overloading the cause should be ascertained in each case so that if possible the breakdown will not occur again from the same cause. When not caused by overloads, breakdowns are usually the result of some part of the equipment being out of condition, and as proper inspection and maintenance of the equipment will largely overcome these breakdowns, it is generally considered to be a good investment. Breakdowns due to overloads can be very largely overcome by the constant checking of loads by meters, and this phase of the subject will be treated more fully later in this article. In electrical work the aim should be to make the installation safe, so that workmen cannot possibly get hurt by coming in contact with live wires. Most State and city laws require that electrical work be done in an approved manner, and the various insurance underwriters have drastic regulations, but with all these precautions there are still chances for men to get hurt, and this subject therefore requires constant attention.

If a plant is producing its electric power, it is usual to generate direct current, as variable speeds are easily obtained by the use of a rheostat. If power is purchased it is generally alternating current, except in the centers of some of the older cities, where direct current is still supplied. The power companies usually bring their power to the high tension side of the transformers and put it up to the customer to take care of all wiring from the low tension side of the transformers. With alternating current the starting torque of the motors is not as good as with direct current, and in order to get variable speeds it is necessary to use special motors such as slip ring motors. When power is purchased the rate schedules should be thoroughly gone into so that the plant will get the benefit of the lowest rate possible. It is also necessary to keep a careful check on the use of power to see that it is not wasted. When fuses blow or motors burn out there is usually something wrong and a careful investigation should be made if the same motor continues to give trouble. In one of the earlier articles

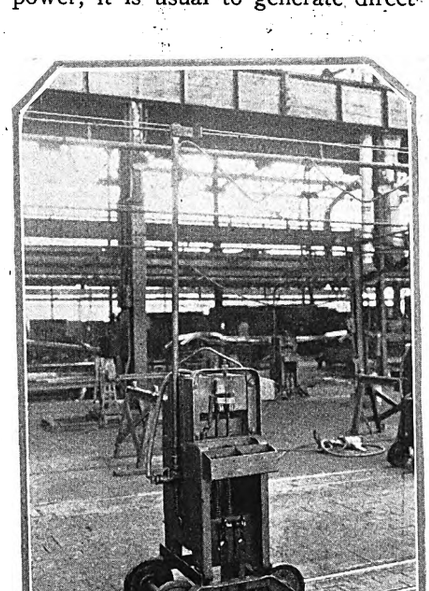


Fig. 3. These electric riveting machines, with overhead trolley current supply, are big time savers in an automobile frame plant.

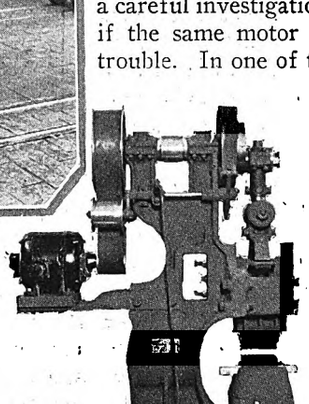


Fig. 4. Individual motor drive, as on this compact hammer, affords many economies over the old time lineshaft; especially where the load is extremely variable.

Fig. 6. The electric arc furnace, with its high temperature and freedom from oxidation, is being used more extensively for metal melting in the production of special tool steels. The heavy current employed requires careful attention to the wiring and control boards.

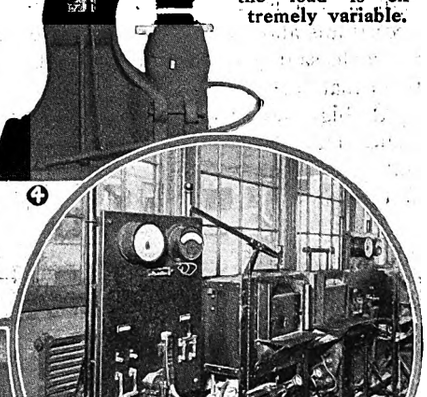
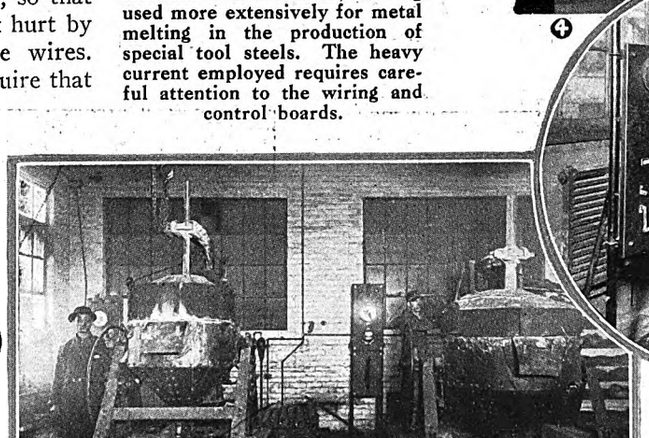
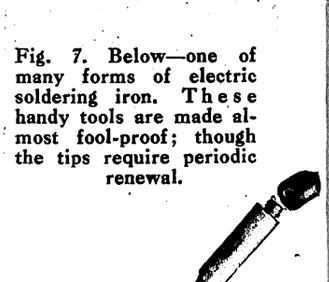


Fig. 5. Even heat control, plus a neutral atmosphere, make the electric furnace especially valuable for heat treating of metals.

Fig. 7. Below—one of many forms of electric soldering iron. These handy tools are made almost fool-proof; though the tips require periodic renewal.





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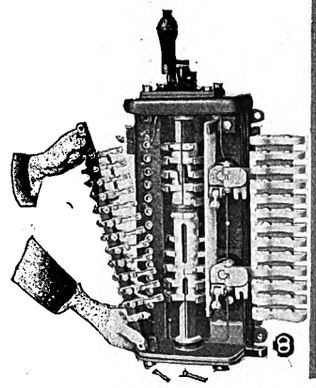


Fig. 8. Drum type controllers are generally used on reversing service. These are usually made easily accessible for cleaning and inspection.

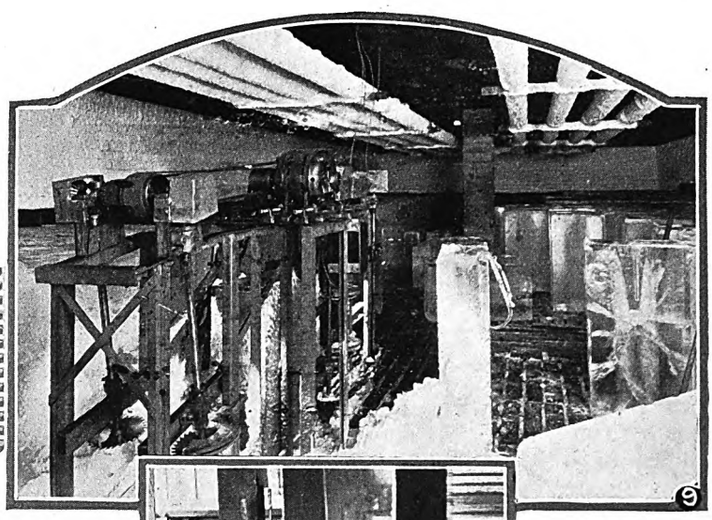


Fig. 9. Motors in extremely cold places are less likely to heat up; but it is well to watch that the lubricant is suitable to low-temperature work.

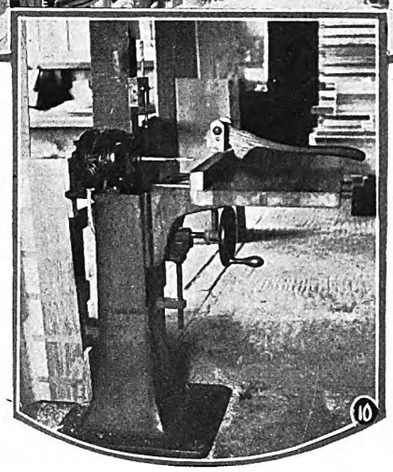


Fig. 10. This motor was converted into a horizontal wood borer by mounting a thrust bearing on its shaft and facing off the bearing housing.

on millwrighting, the point was brought out that tight belts and shafting out of line caused friction and increased the power bill. Tight bearings or bearings without sufficient oil are also power eaters and the use of ball or roller bearings is very often advisable in order to get economical results. Motors which are not loaded are not economical because they cause a low power factor, and it should be the aim of every wide awake engineer to load up motors that are underloaded, to increase the power factor and thereby reduce the power consumed. Coal and power costs are high, and it is easy for wide awake electricians and engineers to make appreciable savings by watching conditions that tend to increase costs.

All high tension wire and equipment should be thoroughly insulated, and guarded at a sufficient distance, so no one can come near it. Transformers are usually oil cooled and the oil temperature is therefore an indication of the temperature of the windings. The present tendency is to install a dial thermometer on each transformer and in many cases to have this thermometer equipped with an electric alarm set to ring a bell when the temperature reaches a certain point.

It may usually be assumed, where power is generated in the plant, that it is direct current, and when power is purchased, that it is alternating current. These current characteristics should be carefully studied and arrangements made for breakdown service from the central station if power is generated in the plant. This breakdown service is expensive and it may be advisable to take care of only a portion of the load, thereby keeping the important units running. When power is purchased, arrangements should be made for breakdown service, either by having a small generator in the plant or by having two sources of supply.

The selection of the correct kind of motor for each job is very important. Direct current motors are preferable for adjustable speed service, for reversing service used on cranes and hoists, and for service requiring frequent starting with high starting torque. In dusty places totally enclosed motors are necessary but as this stops the ventilation of the motor

(*Continued on page* 85)

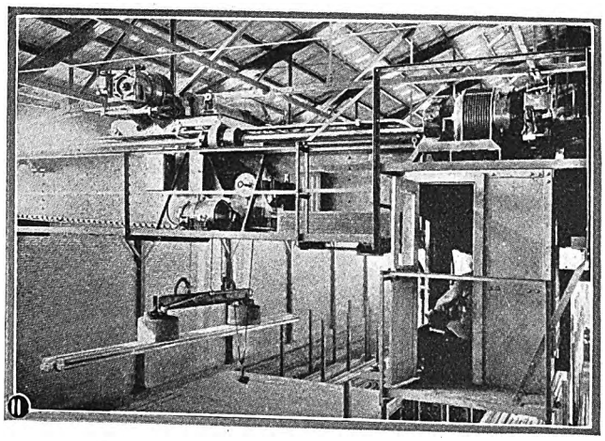


Fig. 11. Elevator and crane motors, with their frequent stops and reversals, are exceptionally hard on starting panels, and these should be under constant inspection.

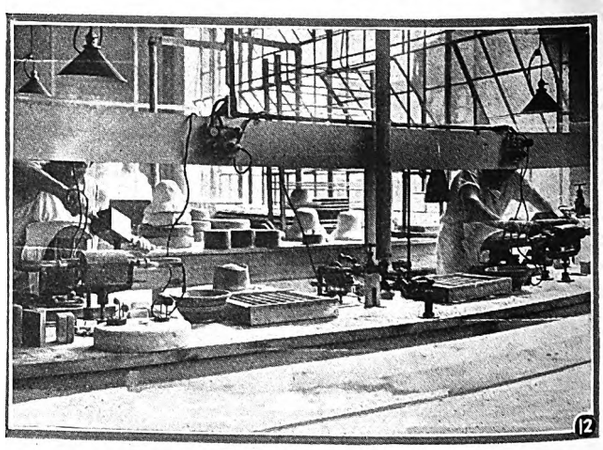


Fig. 12. The growing use of special electric heating devices brings with it a need for better knowledge and intelligent care. The saving due to proper care is often startling.

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American Industry and the Immigrant

By Fred H. Rindge, Jr.

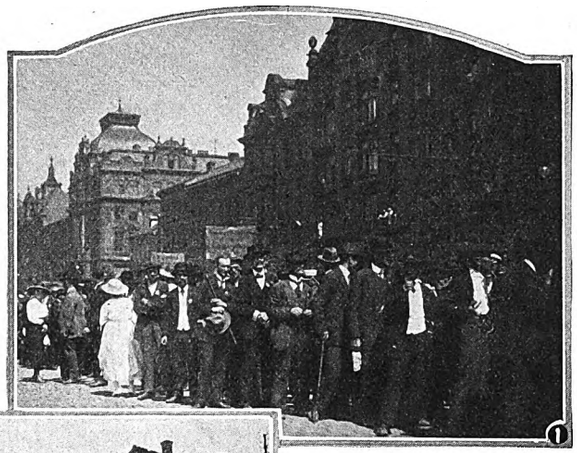


Fig. 1. A Workers' Parade (of which there are so many in European cities nowadays) in Prague.



Fig. 2. Four thousand miles away, in a little Slovak town, the word "New York" conjures up a land of hope.



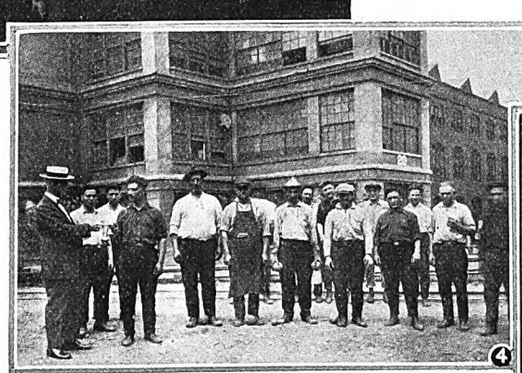
Fig. 3. These are would-be workers in our industries and on our farms. Our treatment of them has much to do with our future relations with their homeland.

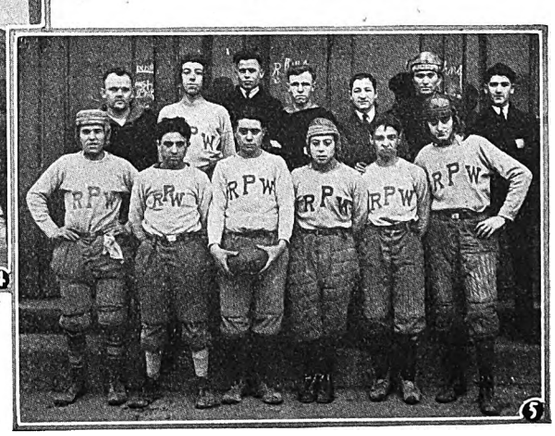
AMERICAN business is tremendously concerned with problems of emigration, immigration and Americanization. In many of our industries twenty to eighty per cent of the employes are aliens. Yet, it is a revelation to some of us that there are nearly 15,000,000 foreign-born in America, and 22,000,000 of foreign parentage—one-third of our entire population!

I have recently visited twenty-three of the countries from which these people come, and am more convinced than ever that they bring with them not only problems but sterling qualities of which we must be more fully cognizant. In the decade previous to the war we averaged 1,000,000 immigrants annually. During the present fiscal year (ending June 30th) we will receive approximately 335,000. This is due to our immigration restriction law, which limits the number from each country to 3 per cent of the number of its foreign-born who were in the United States during the census of 1910. Thus the United Kingdom is allowed the highest quota (77,342); Germany second (67,607); Italy third (42,057) and Poland fourth (31,146). The other quotas are considerably smaller and the majority were quickly filled for the year.

I found the centers of emigration in Europe to be places of intense in-

(*Continued on page* 100)





Figs. 4 and 5. American sports are among the most important influences toward a better mutual understanding among workers of different nationalities.

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The Versatile

How It Serves, in One Form or Another, in

By Matthew

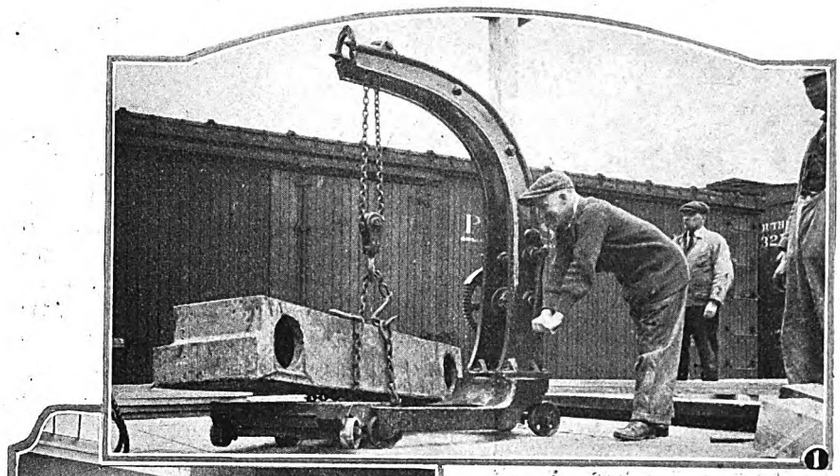


Fig. 1. Small hand-operated cranes reduce handling costs and eliminate danger to workmen from strain.

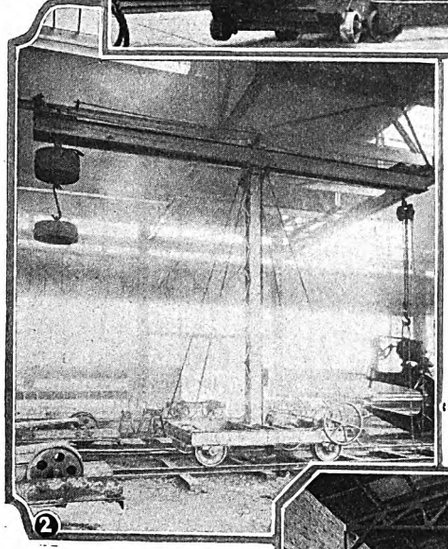


Fig. 2. Cranes can easily be designed to fit the job, and to serve special purposes.



Fig. 3. Hand-power bridge cranes are most efficient where there is only an occasional movement of materials.

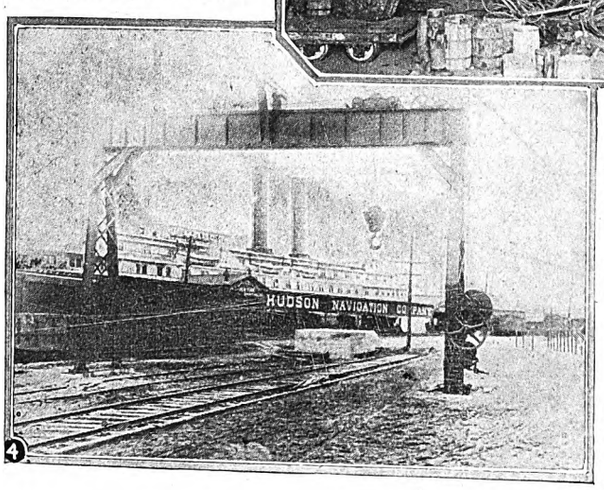


Fig. 4. This hand-operated crane has saved both time and money in the unloading and loading of heavy materials from cars.



Fig. 5. Hand-power pillar cranes can be used in the yard as well as inside the industrial buildings. Note the sling for handling the load.

THE importance of cranes in the plan of economic plant management has been recognized for years and now, when new buildings are contemplated, the first materials handling equipment that presents itself for consideration is some form of crane. The types of cranes which have been and can be used in and about industrial plants are so numerous that it is impossible to present illustrations of each type in one article. The accompanying photographs, showing successful installations, have been selected with an idea of presenting as diverse a number of operations as possible.

As in the case of other equipment, cranes are subdivided into many classes, depending on the nature of the work to be performed, and some manufacturers have given special names to equipment which they have produced to fit a particular job. Some of the classifications for cranes are as follows:

(a) Skeleton.
(b) Walking jib.
(c) Pillar.
(d) Pillar jib.
(e) Overhead traveling (hand-power or power operated).
(f) Gantry (traveling stationary).
(g) Locomotive (steam, gasoline, electric).
(h) Wharf (portable, semi-portable, roof).
(i) Shipbuilding (hammer head, portable, tower).

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Industrial Crane

Construction, Production, and Transportation

W. Potts

Many other minor classifications under these main types could be enumerated.

The advantages of some of the types mentioned need not be explained to industrial executives, as such cranes have long been employed as materials handling equipment, and the benefits derived from their use, such as reduced handling costs, speedier operation, etc., continue to recommend them for use in shops and yards of industrial plants, in railroad and marine work, and in other places and on operations where heavy materials have to be handled.

Because of the diversity of crane equipment, it is difficult to say that any particular type should be used on any certain operation, as so much depends upon plant structure and operating conditions.

In small plants, on shipping platforms and on operations similar to that shown in Fig. 1, the portable crane known as a "skeleton platform" can be used to advantage. The construction of this crane with a rigid curved one-piece boom and mast mounted on a low skeleton platform, which in turn is supported by small wheels, is especially adapted for use in machine shops, as the low skeleton platform will usually pass under the standards of a lathe and many other types of machines used in finishing

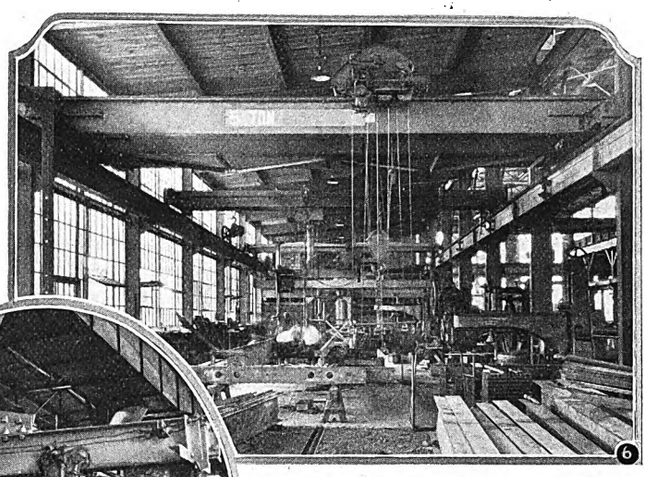


Fig. 6. Cranes are necessities in heavy structural shops. Extended hand control on crane trolley permits the operator to be on the floor near the load.

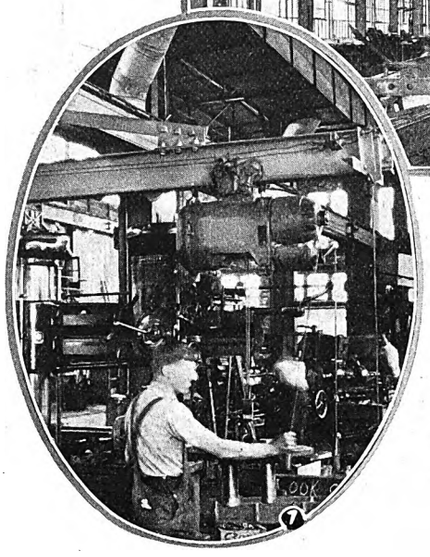


Fig. 7. Electric hoist installed on swinging bracket jib crane eliminates the necessity of operator losing time waiting for a helper to assist him in taking parts or jigs to or from the machine.

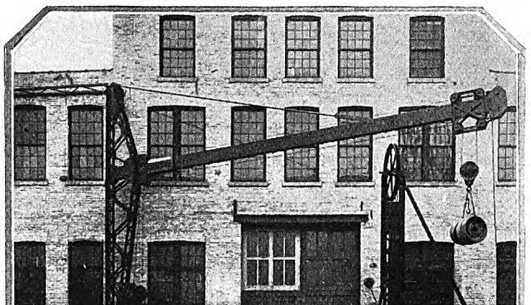
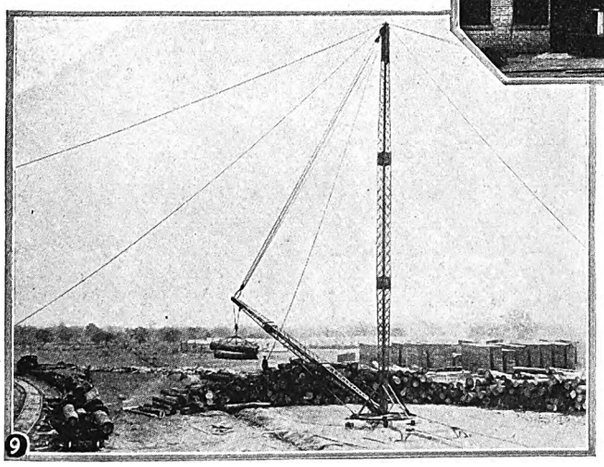


Fig. 8. This jib crane installed in the yard of a large factory has been found very useful for loading and unloading trucks and push cars. It is electrically operated. Note the traveling trolley on boom.

Fig. 9. Derricks are a form of crane. This derrick unloads the logs from the cars, piles them, and loads them again for delivery to the mill.



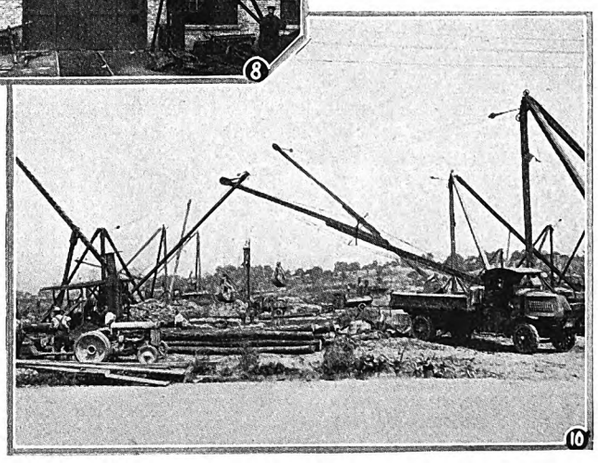


Fig. 10. Wooden derricks equipped with grab buckets are common to large construction projects. This is the equipment used on the foundations of the Bronx Terminal Market.

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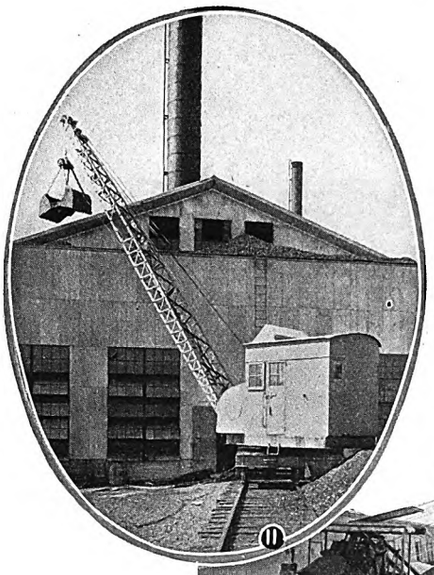


Fig. 11. Locomotive traveling cranes are usually operated by steam. This one handling coal from storage pile to power house is electrically operated.

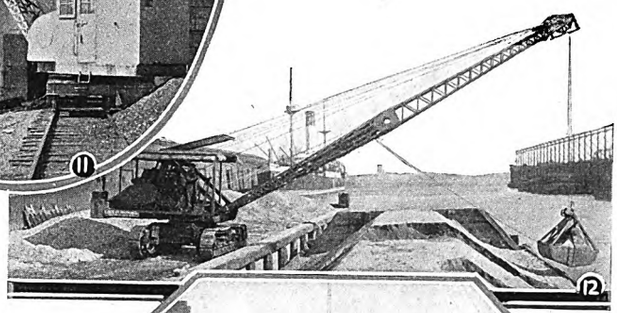


Fig. 12. Gasoline cranes mounted on caterpillar tractors are now becoming quite common. They invariably reduce handling costs and handle bulk materials quicker than shovel gangs on the operation shown.

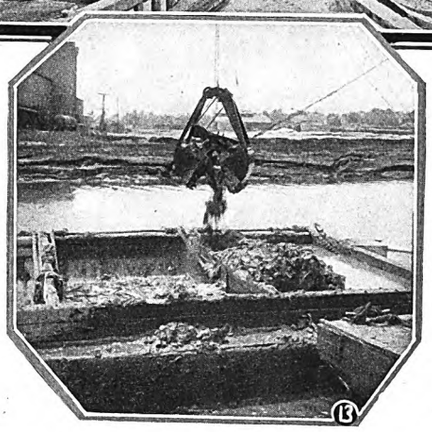


Fig. 13. The equipment below the crane hook is as important as the crane. A clam-shell bucket is generally required on work of this nature.

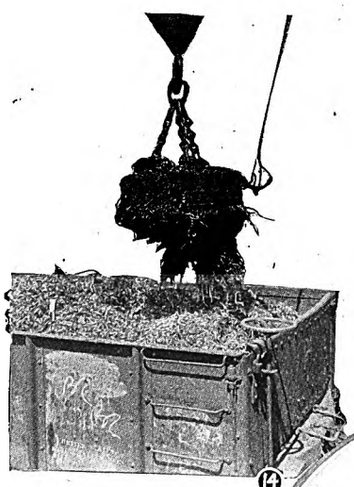


Fig. 14. Electric magnets assist the crane in handling materials of this nature.

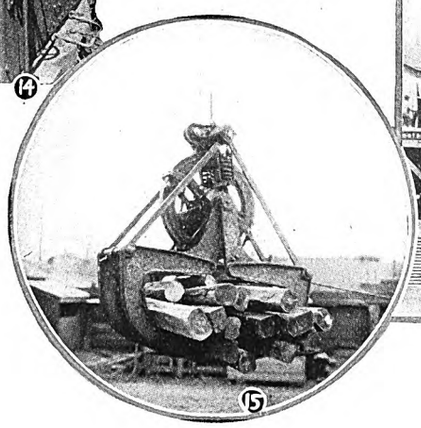


Fig. 15. Neither the clam-shell bucket nor the electric magnet could be used for handling ties. The device shown has proven a success.

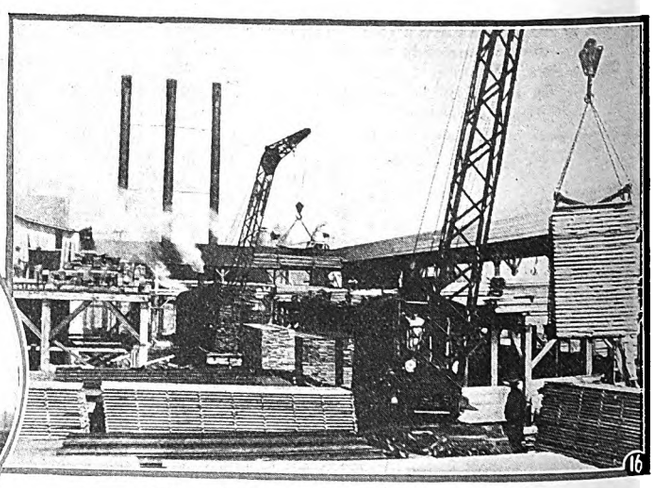


Fig. 16. Cranes can handle flat lumber as well as ties by special attachment. A regular standard lumber handling crane will handle all the way from 100,000 to 300,000 feet per day.

machine parts. With this crane it is possible to bring a heavy casting close up to a machine and hold it suspended on a jib hoist, until it has been adjusted to the machine ready for operation. Fig. 1 shows such a crane, and illustrates the method of operation. In this type the boom curves directly over the platform so that the weight of the load will not topple the crane. The hoisting hook is attached to a sheave block carried by the hoisting chain and is suspended from the end of the curved boom. The hoisting chain runs over a series of sheaves on the boom and thence to the hoisting mechanism, generally a gear type winch near the foot of the mast. The power is applied to this geared winch by means of a hand crank and man power.

Occasionally special operations and conditions require special cranes, and the one shown in Fig. 2 illustrates what can be accomplished. This crane has a 2-ton capacity and is operated by hand. The revolving or swinging type of boom permits the serving of a large area. It will be noted that the lifting mechanism consists of a chain hoist and that the boom is counterweighted so as to balance the punch which is suspended from the chain hoist hook. The longitudinal movements of the crane are taken care of by means of the large hand wheels on either side. This type of crane would come under the classification of walking jib cranes.

The most common types of cranes are the overhead traveling and locomotive. These cranes are used indoors or outdoors, in foundries, steel mills, machine shops, power and coal-

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ing stations, in warehouse or storage yards; in fact on any industrial work where the lifting and moving of heavy materials are required.

The overhead traveling crane is more generally used within the industrial plant because of its adaptability to manufacturing processes. Being installed on an elevated runway it permits the use of the entire area of floor space within its range for storage or manufacturing purposes, and having both transverse and longitudinal motion it will reach any part of a room or space in which it is possible to provide the track. Cranes of this type are constructed and equipped in a great many ways for a wide variety of uses, ranging from the single girder of short span, equipped with a simple chain or air hoist and handling comparatively light weights, to the four or six girder cranes, and the general purpose cranes with box or lattice type girders equipped with crane trolleys and hoists capable of raising 300 to 400 tons or more.

Different types of overhead traveling cranes are shown in illustrations Figs. 3, 6, 18, 19, 20, 22, 23, 24, 26 and 27 and some of the many places where they can be economically operated are presented. Fig. 3 shows a hand-operated two-girder overhead traveling crane being used in connection with the storage of heavy equipment used by erectors and contractors. This same type of crane can be used in manufacturing buildings, power houses, etc., but as far as its use in the storeroom is concerned it is well to mention that it is confined solely to the transportation of heavy equipment over the floor to the shipping

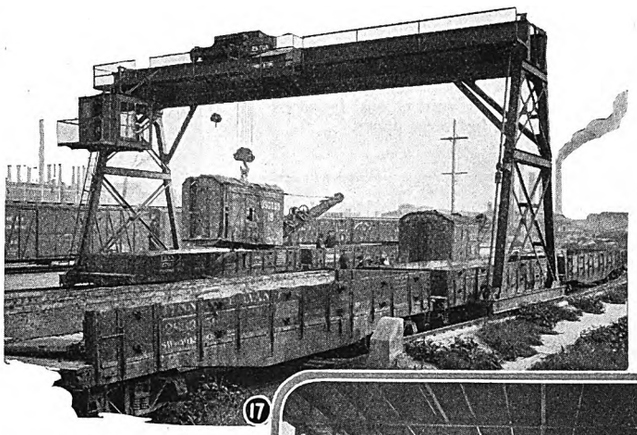


Fig. 17. This electric gantry crane with a span of 59 feet, a 25 ton main hoist and a 5 ton auxiliary hoist, in the freight yard of the Pennsylvania and Detroit R. R. speeds up the loading and unloading of cars.

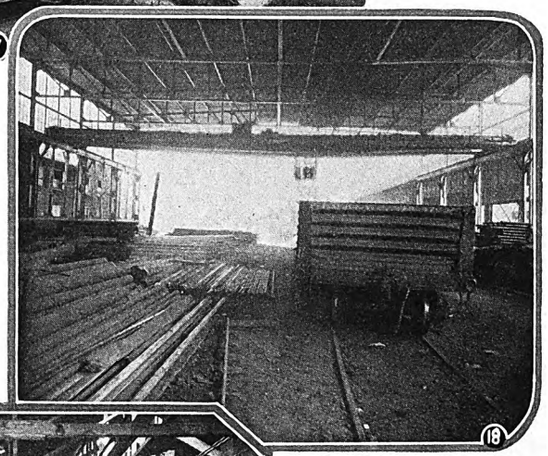


Fig. 18. Cranes can be built for almost any capacity and any span. The one shown has a capacity of 5 tons with a span of 97′ 6″.



Fig. 19. This crane is a typical heavy-duty steel mill design, yet when installed in a low building, the crane only takes 2′ 6″ head-room, and the crane-hook when in its highest position is only 3′ 8″ below the highest point of the crane.

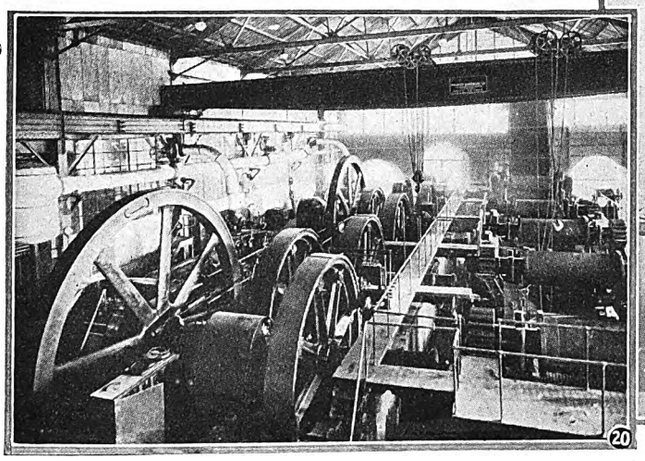


Fig. 20. Where heavy machinery is installed, a traveling crane is a necessity and will save money during installation and on all maintenance and repair jobs where heavy parts have to be removed.

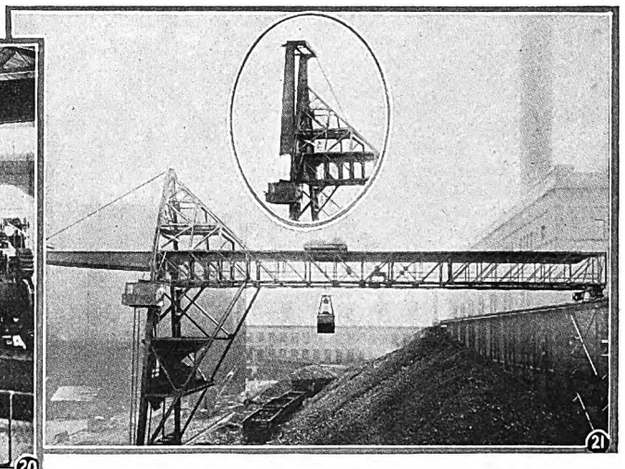
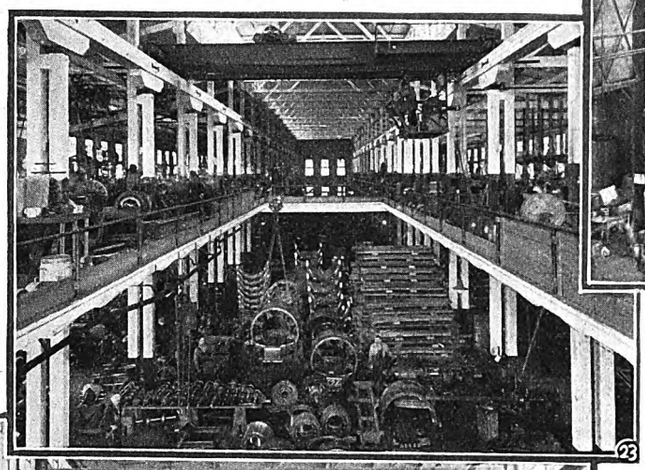


Fig. 21. This gantry crane has a movable cantilever which permits running beyond the gas-holder which otherwise would have limited the longitudinal travel.

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Fig. 23. Industrial plants, both chemical and mechanical, provide crane bays and balconies, which allow raising and lowering materials between floors.



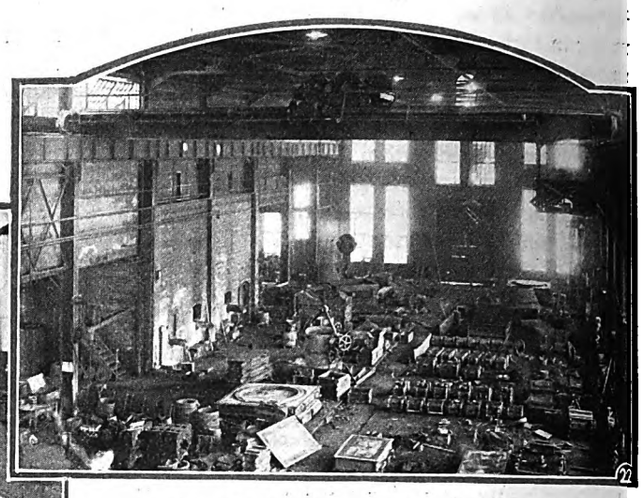


Fig. 22. Foundries use traveling cranes for many materials and handling operations. As the bird's-eye view shows, handling on the floor would be practically impossible,

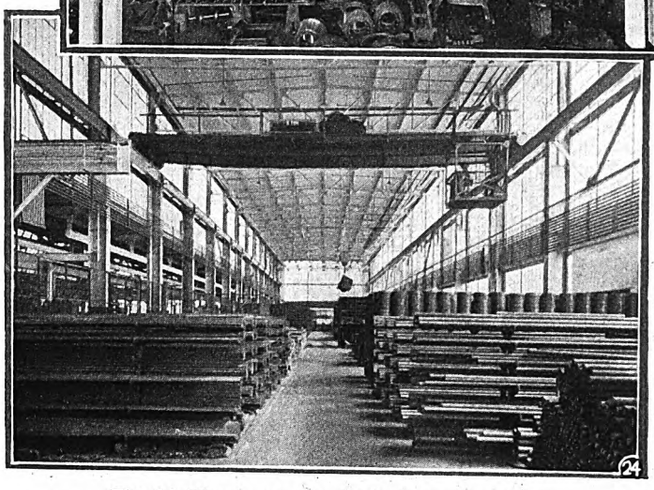


Fig. 24. Warehouses for long pieces, bar stock, and heavy materials, have found traveling cranes to be one of the best types of materials handling equipment to reduce handling costs.

door for loading onto trucks, etc., and for taking equipment from trucks and placing it in the proper storage space. The use of a crane in this capacity is purely to eliminate the high cost of handling in and out of the storage house. Two men and the crane can move very heavy equipment with very little effort; there is no necessity to use rollers and planks, thus possible accidents are avoided, and the entire floor space can be used for storage purposes.

The importance of cranes in structural shops is clearly shown in Fig. 6 where three different cranes can be seen in a manufacturing bay about 60 feet long. The two cranes in the rear are hand operated and are equipped with electric drills in place of hoist hooks, while the crane in the

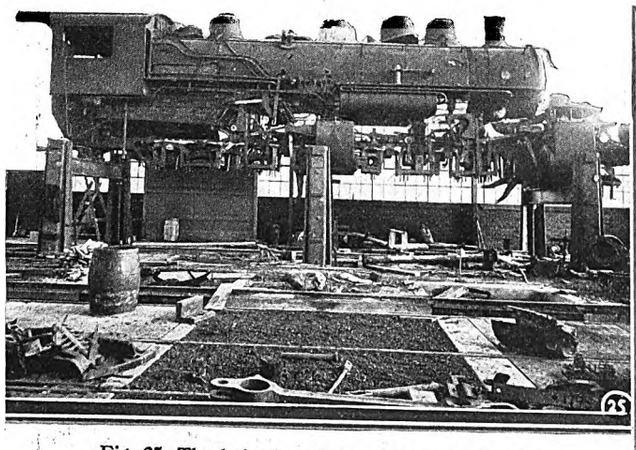


Fig. 25. The hoist is a form of crane, and this Six-Jack locomotive hoist can easily handle a 300 ton compound locomotive for de-wheeling.

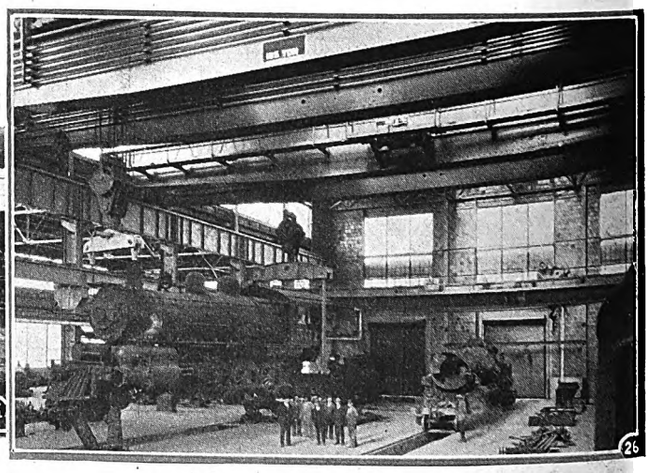


Fig. 26. Heavy loads can best be handled by cranes. These two 125 ton electric traveling cranes have a span of 97′ 5½″ and are used for handling locomotives in the shops of the Chicago, Burlington & Quincy Railway, Denver, Col.

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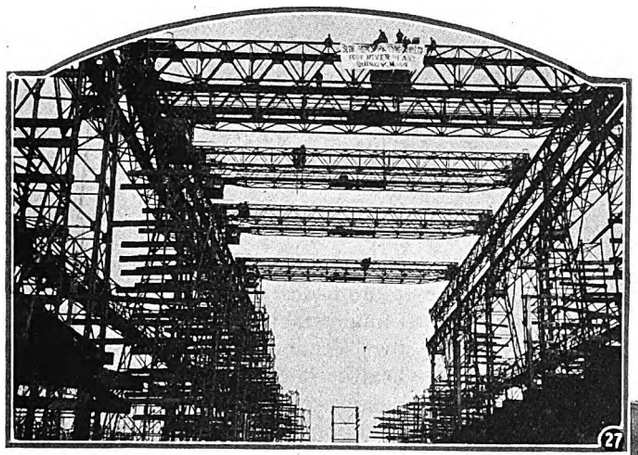


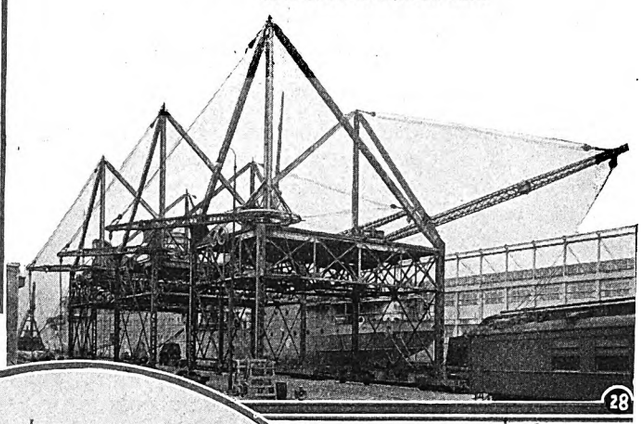
Fig. 27. Shipyards and ships have for many years used cranes for the handling of materials. This shows the cranes over the ways of the Bethlehem Shipbuilding Corporation, Fore River Plant, Quincy, Mass.

foreground is electrically operated. This crane is equipped with a convenient floor control instead of a cab control. When the span or movement of the crane is short, a floor control may be used to advantage. The operator being on the ground near the work, can move the load as desired, and his being adjacent to the load, will naturally reduce the possibilities of accidents. In addition if constant service is not required, and the State laws will permit, the crane can be operated by a workman engaged in the work in progress, thus eliminating the expense of a special crane operator.

A crane similar in design to that shown in Fig. 3, but of longer span

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Fig. 28. This installation of three large gantry cranes is equipped with derricks on alternate corners. These cranes are electrically operated and they are self-propelling, obtaining the power by means of a shoe and third rail.



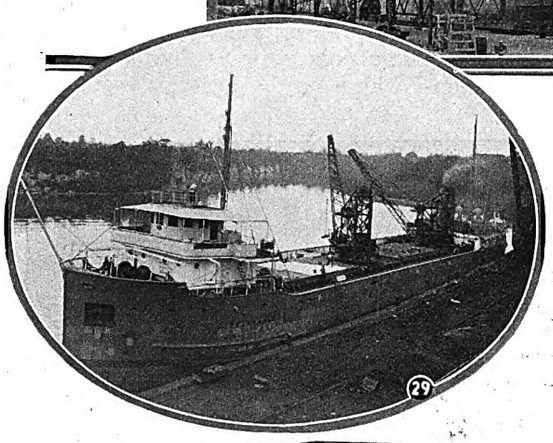


Fig. 29. The Isthmian Steamship Line's ship "Steel Vendor" is especially equipped with two unloading cranes for the handling of steel. These cranes eliminate a great many masts and booms which otherwise would be required.

Fig. 30. This revolving double cantilever crane serves a large storage area for handling clinker at the plant of the Riverside Portland Cement Company, Riverside, Cal.



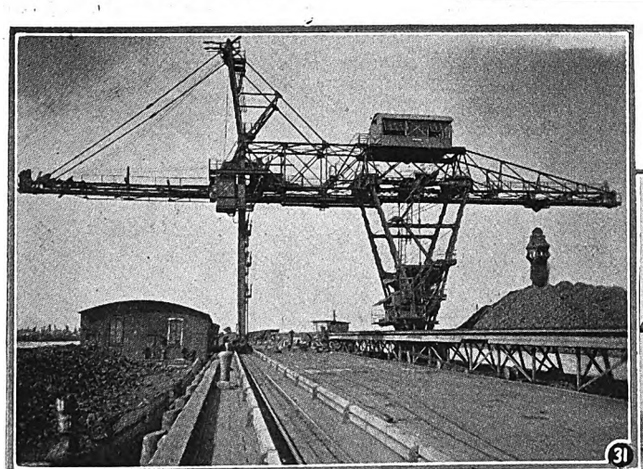
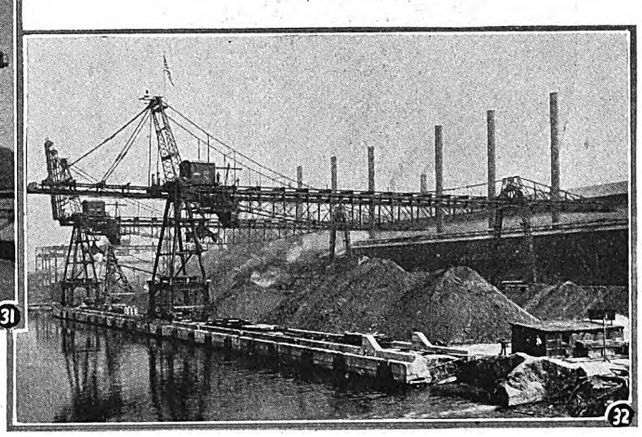


Fig. 31. The structural details of cranes can be designed to meet practically any condition. This electric rope system bridge tramway is arranged to operate a 4 ton ore or coal grab bucket, and in addition is equipped with a hopper and weighing device.

Fig. 32. Steel mills and large users of bulk materials, received at the plant by cars or ships, find the bridge tramway with large capacity buckets, an economic factor in their handling costs.



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Bigger Than Muscle Shoals

Constructing the San Joaquin-Big Creek Hydro-Electric Project

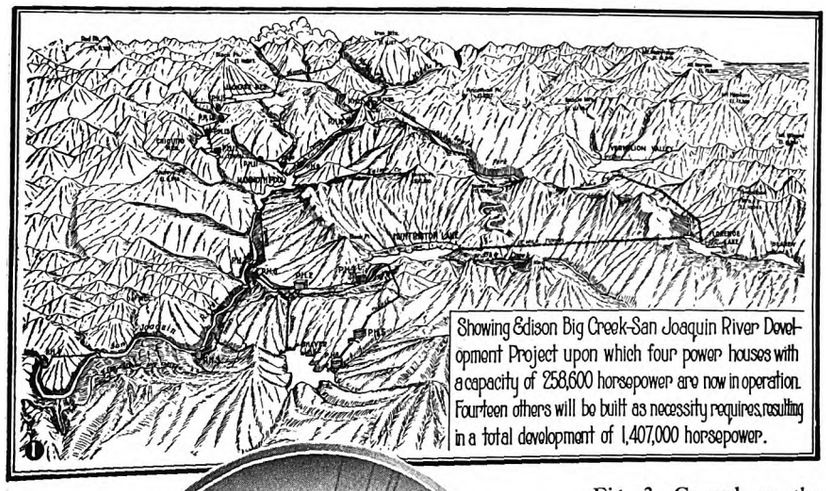
By Herman J. Hanna

THE remarkable growth of the State of California is a matter of universal knowledge; and the reason generally attributed is that of more comfortable living conditions, together with the general tendency of all peoples westward. The increase in population indicates there must be a more substantial basis than that of an equable, mild climate. This is true, for the varied industries, the agricultural development, the extractive industries, foreign trade, and the caring for the needs of those living here, have made the growth of this State equal in practically all other respects that of its population. The superior climatic conditions have enabled the people to develop to the utmost the resources found here.

However, industry and population can only grow as they are supplied with power. California has not been blessed with deposits of coal, and the continuance of its supply of oil for commercial uses is uncertain. But in the "White Coal" on its mountains lies the latent energy that will make possible a further increase in population in keeping with that enjoyed in the past.

This is being accomplished in Southern and Central California by the San Joaquin-Big Creek hydro-electric project of the Southern California Edison Company. When completed, in 1935, there will be made available for power requirements of this section, 1,407,000 horsepower of electrical energy. This will meet all power demands, keeping steadily ahead of the needs at the peak load period.

In the difficulties encountered and overcome, in the new departures in constructive engineering science, in display of ingenuity to meet unforeseen conditions, and in creative resourcefulness, this project maintains the same proportions towards others as in actual cash outlay. And in its benefits to humanity, in the direct influence in the lives of millions, this project will play just as vital a part as any other. For when the contemplated work is completed, the Edison generating system will have a load and diversity factor equal to supply all the electrical demands of a population of five and a half million people.



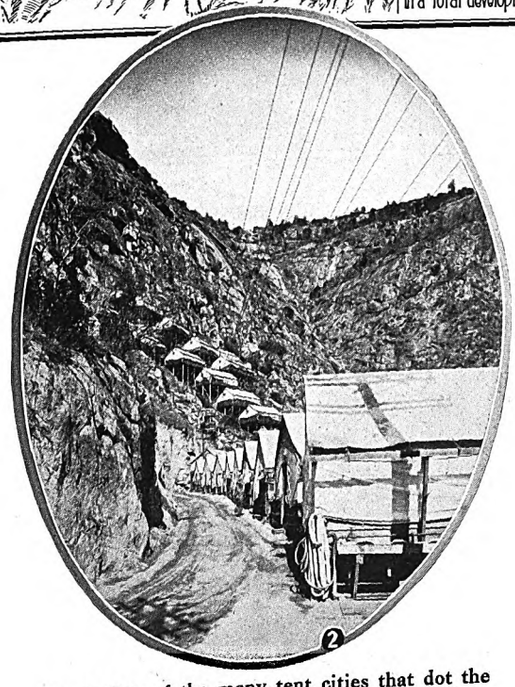
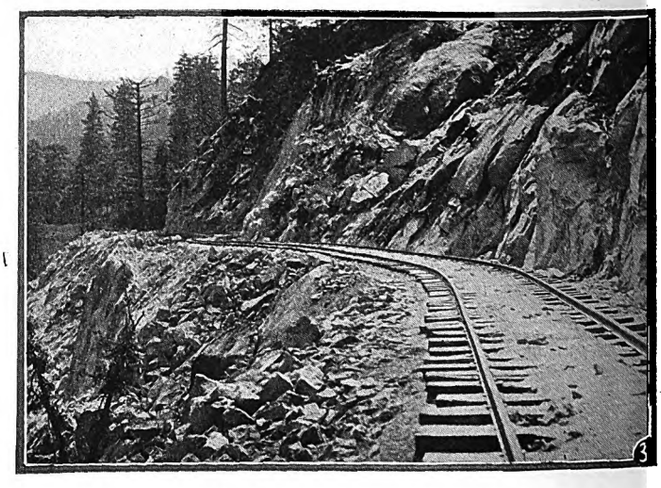


Fig. 2. One of the many tent cities that dot the mountains along the path of construction. These camps, which consist of dining room, club room, baths and sleeping cabins, are built conveniently near section of work where men are employed, and are moved as work progresses.

Fig. 3. Carved on the face of the sheer wall of granite, this railroad is a marvel to engineers and sightseers. The first materials were carried into the mountains with automobile trucks, and as the road was built, an engine was used from El Prado to the end of finished track.



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The Big Creek Development Project is located seventy miles northeast of Fresno in the Big Creek-San Joaquin watershed, in what is known as the High Sierra Mountains. It is a progressive plan of development comprised of a series of reservoirs, dams, tunnels and powerhouses designed to impound and conserve the waters of the San Joaquin and its tributaries, after which they pass undiminished and in more seasonal flow to the ultimate purposes of irrigation, in the San Joaquin Valley. This is conservation in the highest degree.

The water, collected in Florence Lake and led thence to Huntington Lake by means of a tunnel, and also collected from other mountain sources, is ready to pass through the powerhouses which extract its energy. After having been collected in Huntington Lake it may journey successively through Powerhouses Nos. 1, 2, 8, 3 and 4; or it may pass through Powerhouses Nos. 5 and 6, and run into Shaver Lake Reservoir, where it can be stored for another period and sent through Powerhouses Nos. 2A, 8, 3 and 4. In either case, the water falls a vertical distance of over one mile. The electricity so generated is then to be transmitted to load centers in the San Joaquin Valley and in Southern California, the latter a distance of 270 miles.

The history of the project, and outline of work to be carried out in the future, is highly interesting and instructive. In 1883 John S. Eastwood, a noted engineer, made the first trip into the Big Creek-San Joaquin region and conceived the idea of its hydro-electric power potentiality,



Fig. 4. Fifteen feet of snow on Kaiser Pass, at an elevation of 8,200 feet, between Huntington and Florence Lakes in the High Sierra.

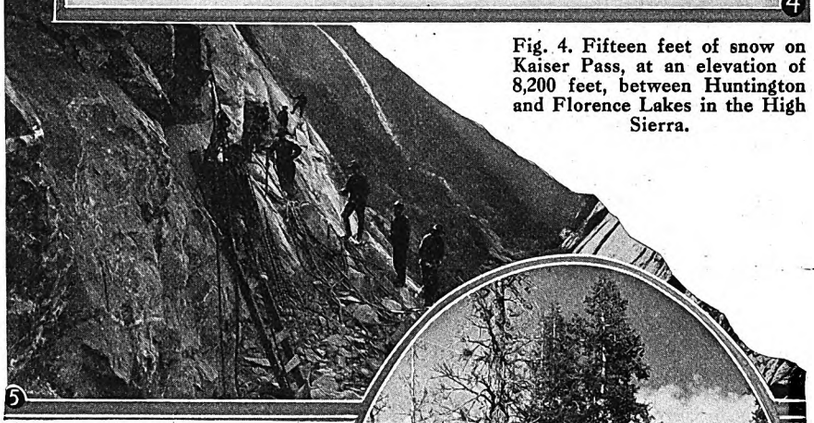


Fig. 5. In preparation for the Edison project, the first step was the building of the automobile road to Cascada, every mile of which was blasted from the granite wall of the San Joaquin Canyon.

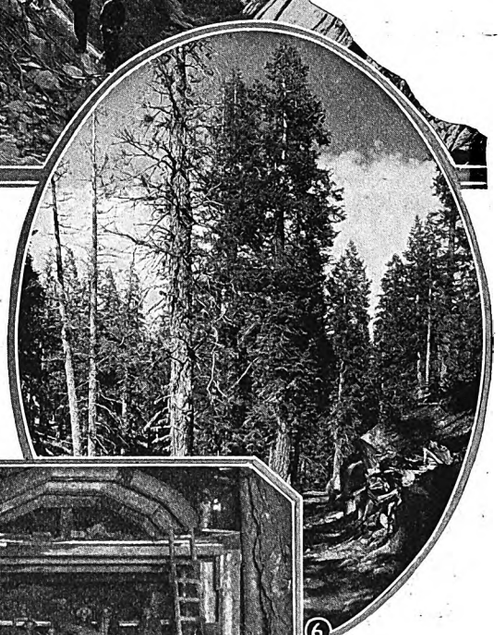


Fig. 6. Automobile road between Cascada and Huntington Lake.

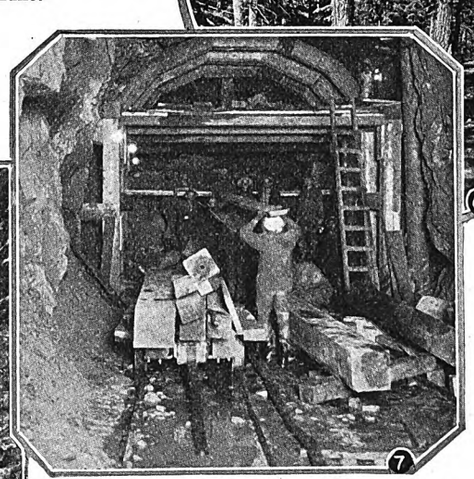


Fig. 7. Preparing to drill another heading, in the process of driving one of the tunnels.

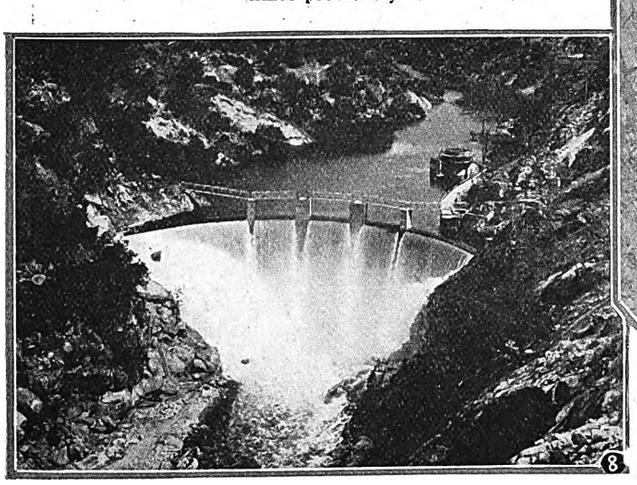


Fig. 8. Diversion dam in San Joaquin Canyon, turning water through tunnel in mountains for use in fourth power house having been used three times previously.

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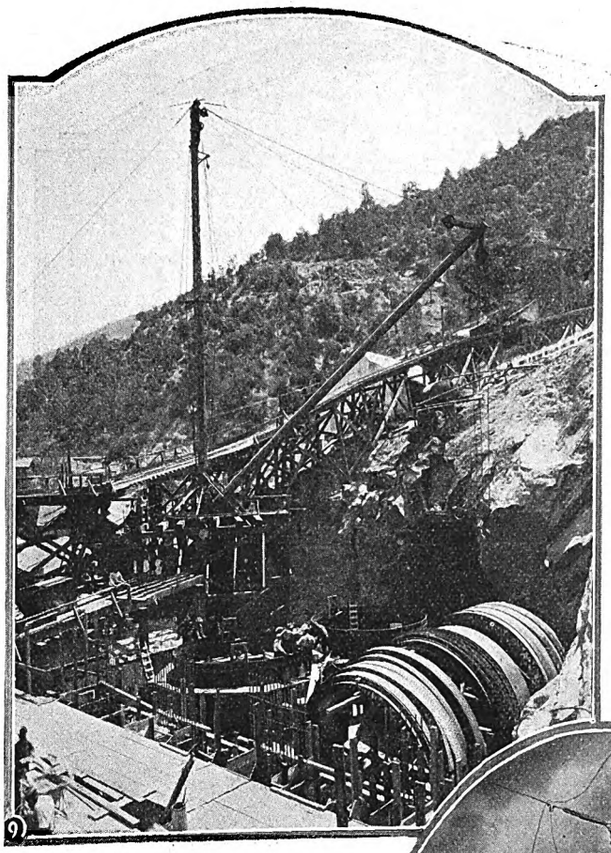


Fig. 9. Assembling 18-foot penstock at terminal of six mile tunnel conveying water to Big Creek Plant No. 3. Just below this point is a manifold where the water is divided for three separate penstocks, each supplying one water wheel.

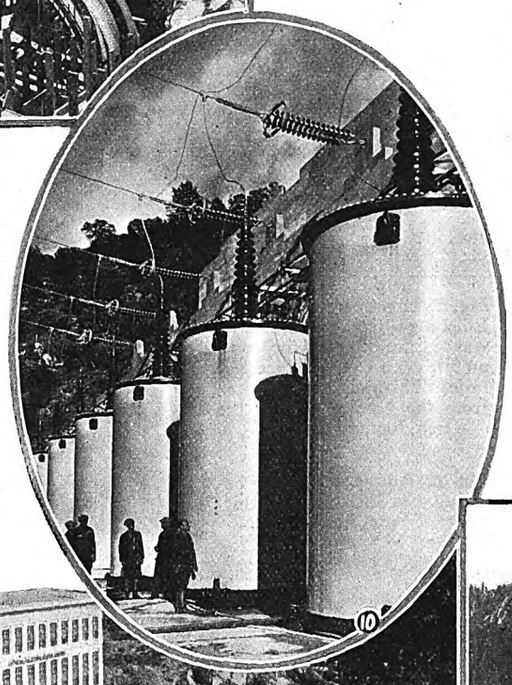


Fig. 10. 220,000-volt transformers at one of the power houses. Each transformer has a capacity of 18,500 kva.

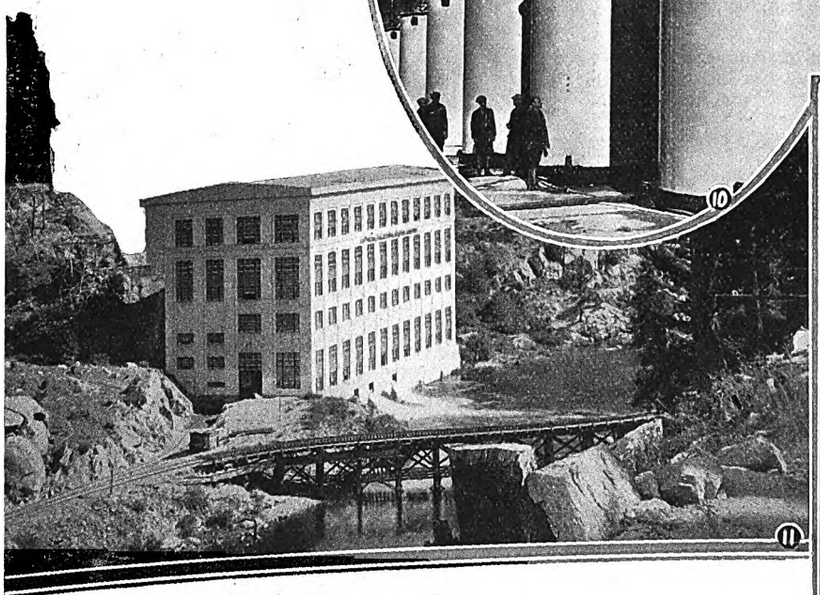


Fig. 11. Edison plant No. 1, contributing 66,000 horsepower to the Edison system.

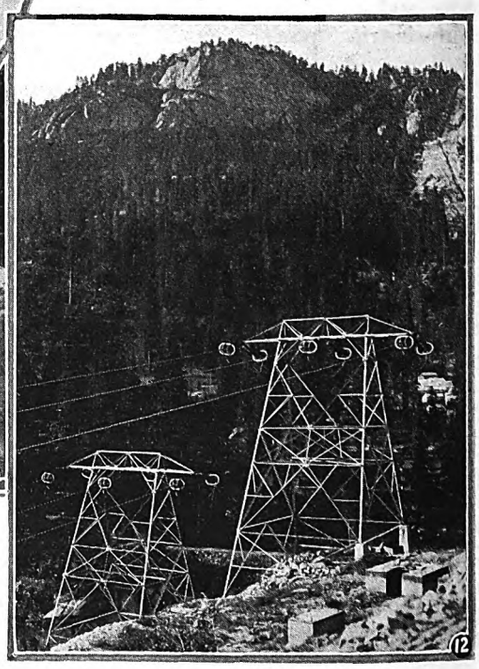


Fig. 12. 220,000-volt transmission line connecting the generating plants at Big Creek with the distribution centers near Los Angeles—275 miles away.

which was far in advance of any market demand.

Early in 1910, Mr. George C. Ward, now vice-president in charge of construction and operation, and an experienced engineer who holds the record of having built the greatest electric water-power properties in the West, went over these regions with a practical purpose in view. He was accompanied by Mr. H. E. Huntington, the railroad and empire builder of the Southwest, in whose interests he made the reconnaissance. Mr. Ward was probably the first man to look upon these watersh ds with something definite in view, because up to that time there was no possible market for their electric power products, as the Edison Company was supplying the electric requirements of Southern California from its plants in the San Bernardino Mountains and up on the Kern River.

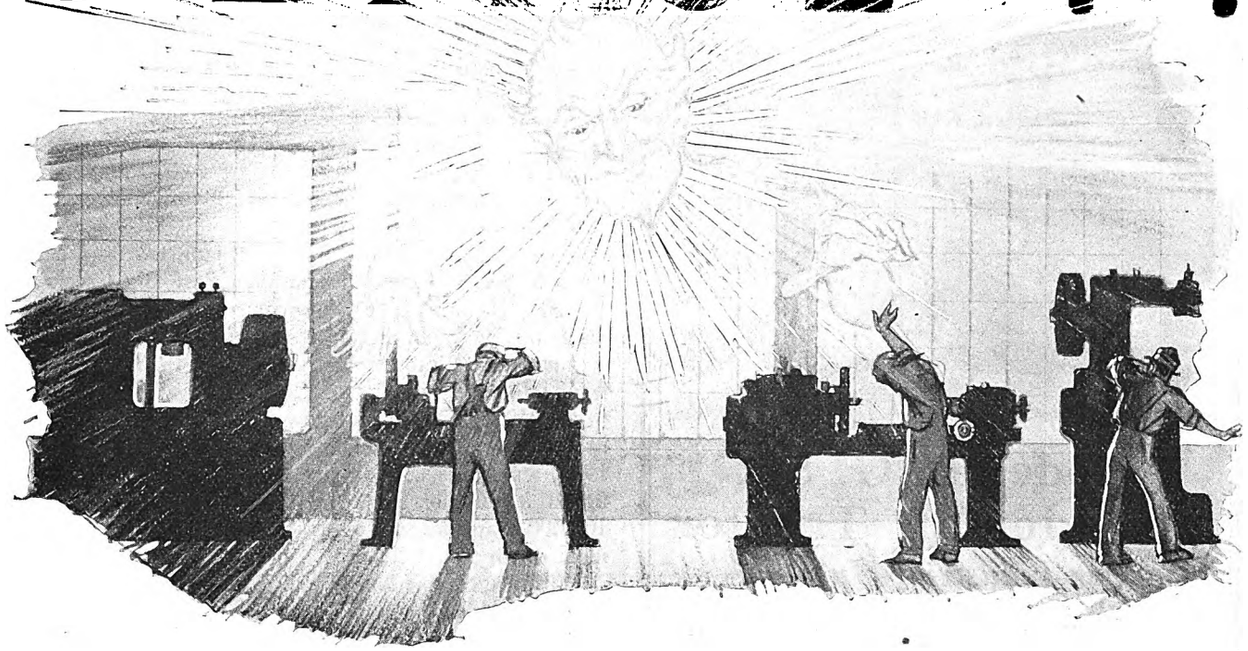
About 1911, the enormous demand for transportation power for street railway use in Los Angeles and on interurban lines caused Mr. Huntington to begin actual development under the corporate name of Pacific Light and Power Company. In 1917 this corporation was merged with the Southern California Edison Company, which has continued the project.

In 1912 dams impounding Huntington Lake were commenced, and brought to the initial height in 1913, conserving 50,000 acre-feet in the Lake. In 1917, they were raised 35 feet, increasing the storage capacity

(*Continued on page* 38)

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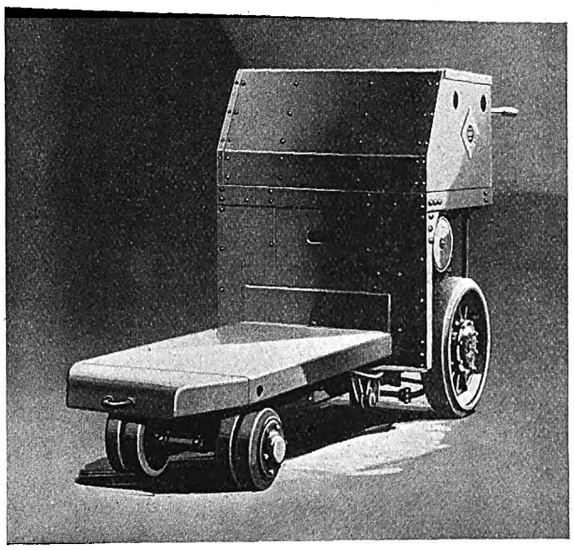
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Ask for Bulletin 51.

The ELWELL-PARKER ELECTRIC COMPANY

Cleveland Ohio

Bigger Than Muscle Shoals

(*Continued from page* 36)

of the Lake to 88,000 acre feet. Powerhouse No. 1 was started in 1912, and completed to an initial capacity of 44,000 horsepower in 1913; and by the addition of a third unit in 1923, increased to a capacity of 66,000 horsepower.

Powerhouse No. 2, six miles down the canyon of Big Creek from Powerhouse No. 1, was also completed at this time with an initial capacity of 44,000 horsepower, which was increased in 1921 to 66,000 horsepower by the addition of a third unit.

The third powerhouse in the stream, two and a half miles below No. 2, at the confluence of Big Creek and the San Joaquin River, known as Powerhouse No. 8, was built with an initial installation of 30,000 horsepower and put into service in October, 1922.

The fourth powerhouse (No. 3), the "Electric Giant of the West," five miles below No. 8 on the main stream of the San Joaquin River, was commenced December, 1922, and came into service on October 16, 1923. Its initial installation of three units will generate about 105,000 horsepower. This brings the actual development down to date.

With the completion of No. 3, deep and careful study is being made of the working out of the big problems arising in the successive steps of development. The great and dominating factor in the determination of the problem is to supply at the cheapest possible cost the enormous volume of power which the growth of the ten counties of Southern and Central California require. Next, is to work without interruption the great construction army of the Edison Company, thus minimizing the cost of labor turnover and securing the highest degree of human efficiency.

Some idea of the magnitude of the undertaking may be obtained by a comparison with the world's greatest construction jobs. There being no data available whereby one could ascertain the various items of expense, as labor, materials, transportation, living costs, and so forth, the actual expenditure, dollar for dollar, shows the following to be true:

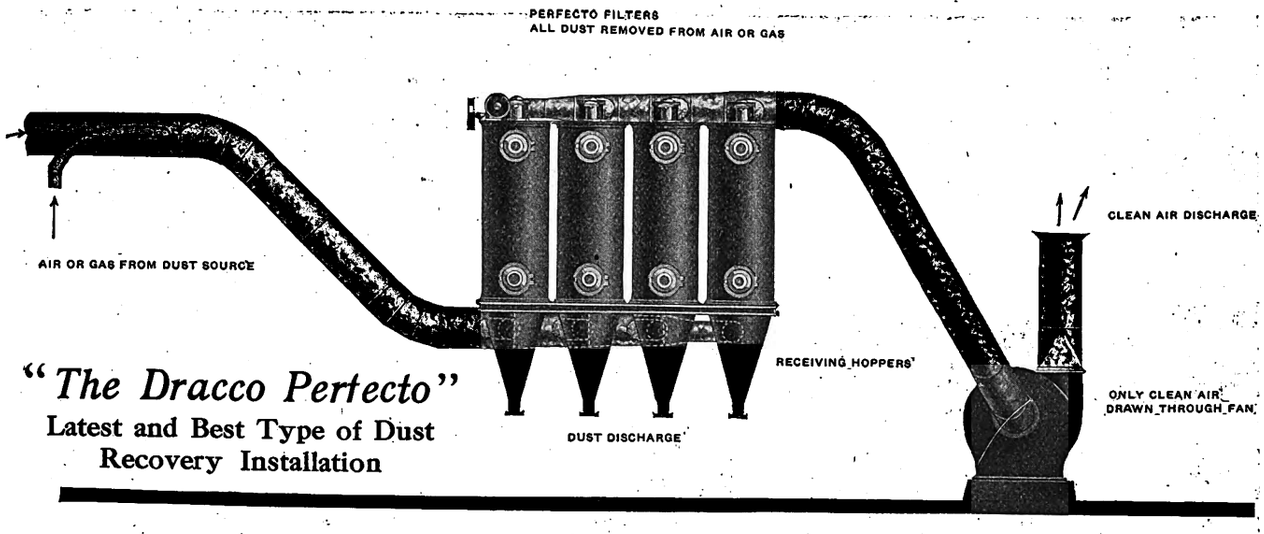
Southern California Edison Company Big Creek-San Joaquin project	$375,000,000
Construction of Panama Canal	360,000,000
Union Pacific Railroad	300,000,000
New York Subways	300,000,000
Nile River Irrigation Project	250,000,000
Terminal Facilities, Passenger and Freight, on New York and New Jersey side of Hudson, including electrical equipment	210,000,000
Catskill Water Supply System (for New York City)	162,000,000
Pennsylvania R. R. for New York City, Terminal and Extension	150,000,000
Erie Canal and Branches, 340 miles	139,214,969
Suez Canal	127,000,000
Proposed New Bridge over Hudson River	100,000,000
Alaskan Government Railway	52,000,000
Hetch Hetchy Water and Electric Project	45,000,000

The contemplated schedule of operations, in general, is designed to extract all possible hydro-electric energy from these waters by increasing the capacities of the reservoirs already formed, and diverting mountain streams and additional sources of supply into them. Then the capacities of the powerhouses already built can be increased and new powerhouses can be installed.

The project is under consideration of starting what is

(*Continued on page* 41)

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"The Dracco Perfecto"
Latest and Best Type of Dust Recovery Installation

Solves Your Dust Problems!

DRACCO FILTRATION OVERCOMES EXPLOSION HAZARD FROM FAN CONTACT WITH FOREIGN PARTICLES

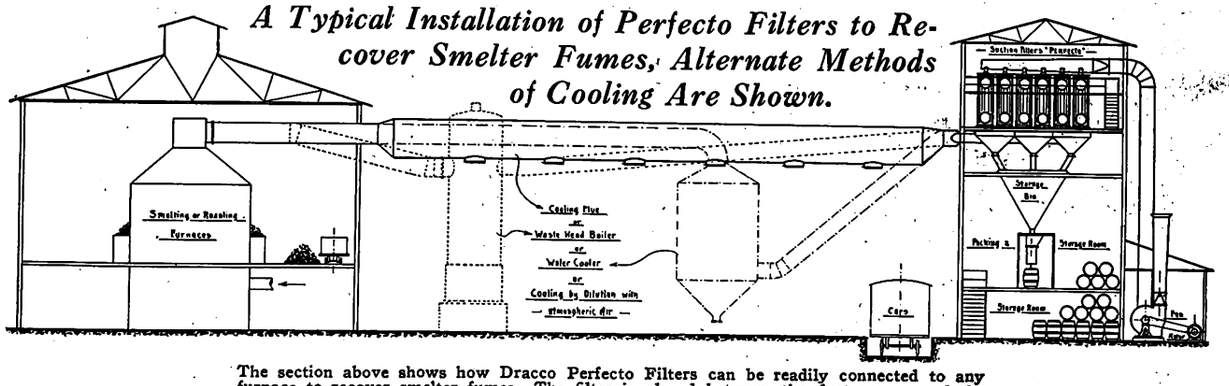
The hazards of a dusty and dirty plant are very great. The only safe guaranty against dust explosion is to keep your plant clean at all time. This can be done most effectively by dust collecting equipment installed on the right principle.

The Dracco System of dust recovery is the outcome of searching investigation by our engineers, of explosions that continually occurred in plants equipped with earlier types of dust collecting equipment.

They concluded that explosions often resulted from sparks created by the fan blades striking foreign particles passing through the air. This cannot happen with the "Dracco Perfecto," because the filter is situated between the receiver and the fan. The fan encounters nothing but super-clean air.

This is only one of the many important features that make Dracco equipment safe and efficient. Let us tell you more about it. Send for our Bulletin.

A Typical Installation of Perfecto Filters to Recover Smelter Fumes, Alternate Methods of Cooling Are Shown.

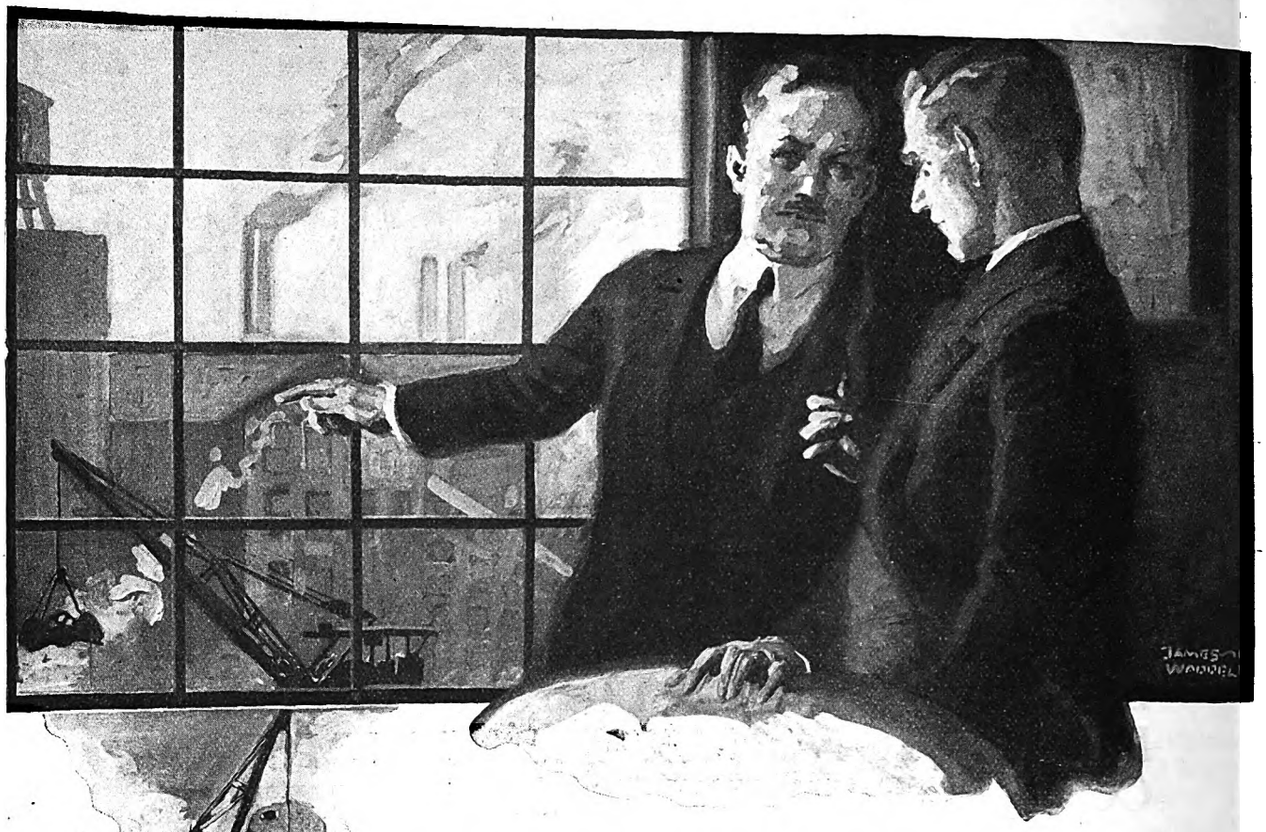


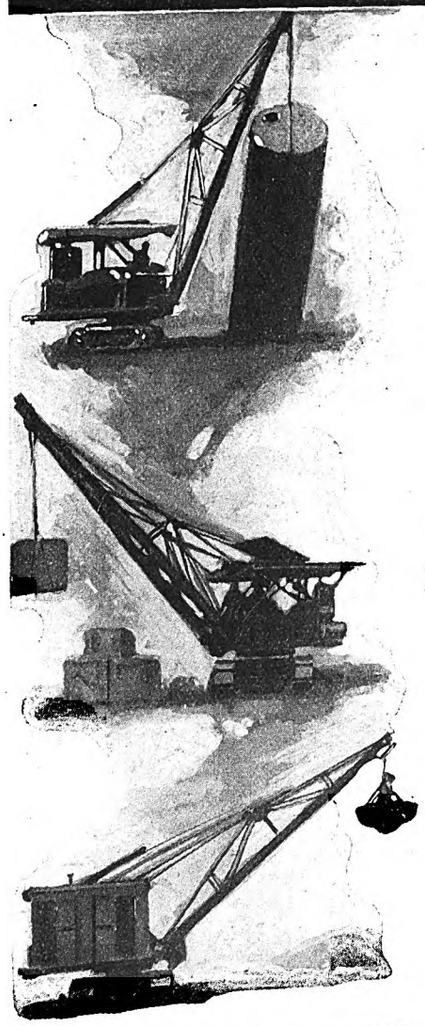
The section above shows how Dracco Perfecto Filters can be readily connected to any furnace to recover smelter fumes. The filter is placed between the dust source and the fan. Only clean gases go through the fan. Where gases are too hot to go directly to the filter, various ways are used to cool the gases.

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THE DUST RECOVERING & CONVEYING CO.
Engineers and Manufacturers, Cleveland, Ohio.

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(*Continued from page* 38)

known as the Pitman-Shaver tunnel, two and a half miles in distance, which will divert, as a first step, the waters of Pitman Creek into Shaver Lake. To impound this additional supply of water another dam is planned across the end of Shaver Lake which will raise the water about 55 feet above the present level, giving a storage capacity of 50,000 acre feet and making the elevation of the water line of the lake 5,330 feet.

While this work is in progress, it will be possible for the Company to increase the capacity of the third powerhouse, No. 8, from 30,000 horsepower to 60,000 horsepower; and to build a powerhouse designated as No. 2A, adjacent to No. 2, with an installed capacity of 70,000 horsepower by 1928.

Work on the great Florence Tunnel and the dam near the intake portal of the tunnel has progressed for over three years, and will be completed during the summer of 1925. After Florence Lake has been impounded and the tunnel completed, the extension of the Pitman-Shaver tunnel into Huntington Lake will make a complete tunnel connection from Huntington Lake to Shaver Lake. This will make it possible to store the flood waters diverted through Florence Lake and this new tunnel into Shaver Lake; and to meet this further demand on its capacity, the Shaver Lake dam will be raised 40 feet. This increased storage will make possible the increase of the capacity of Powerhouse No. 2A from 70,000 horsepower to 150,000 horsepower by 1929, and ultimately to 300,000 horsepower.

By the beginning of 1927 the storage capacity of Florence Lake will be 60,000 acre feet. This will regulate the flow of water through the Florence Tunnel into Huntington Lake, and the further diversion from Huntington Lake into Shaver Lake by means of Huntington Tunnel. At a later date, with a regulated flow of water from Huntington Lake to Shaver Lake, it will be possible to install a first and second powerhouse somewhere between Huntington Lake and Shaver Lake, with possible combined capacities of 134,000 horsepower.

This program brings what is known as the east-side project to its completion; and will make possible the probable increase of the generating capacities of all the powerhouses on the east-side up to their ultimate capacity.

When it becomes necessary, the waters from Bear Creek and from Mono Creek, on which is to be constructed the large Vermillion Valley Reservoir, will be diverted into the Florence Tunnel and used to supply the chain of powerhouses between Huntington Lake and Powerhouse No. 3.

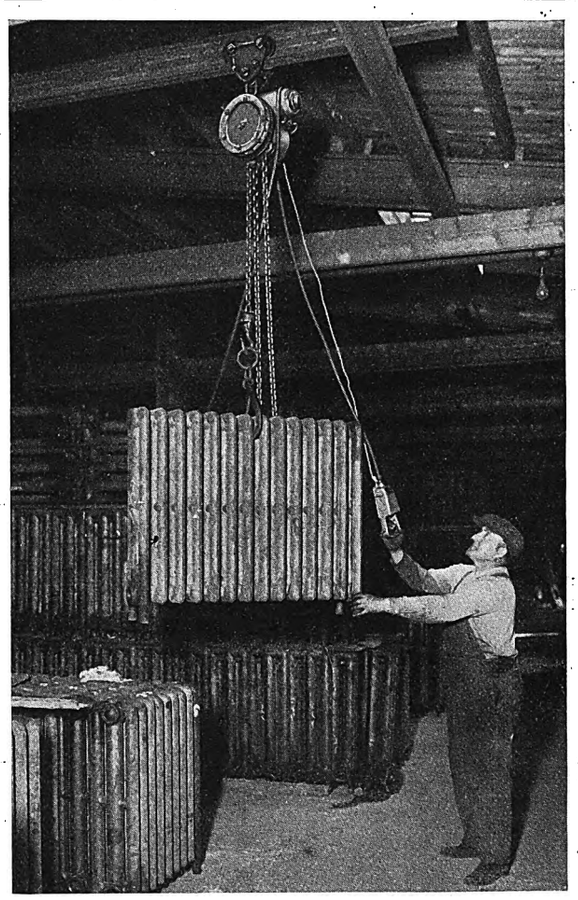
In addition to this chain of powerhouses using the stored waters of Huntington Lake and Shaver Lake, other power sites, not using these stored waters, will be developed as Powerhouses Nos. 9 to 15, located on the Middle Fork of the San Joaquin River, offering an ultimate development of 180,000 horsepower under a head of 3,750 feet. The other groups, known as Powerhouses Nos. 9, 16, 17 and 18, is located on the main San Joaquin River above its junction with Big Creek, and is capable of a development of 135,000 horsepower at a head of 2,150 feet.

Eighty-six miles of tunnel is the dominating physical achievement of this mighty construction project. Engineering difficulties and problems encountered in building

(*Continued on page* 43)

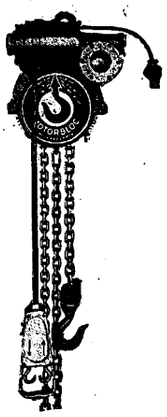
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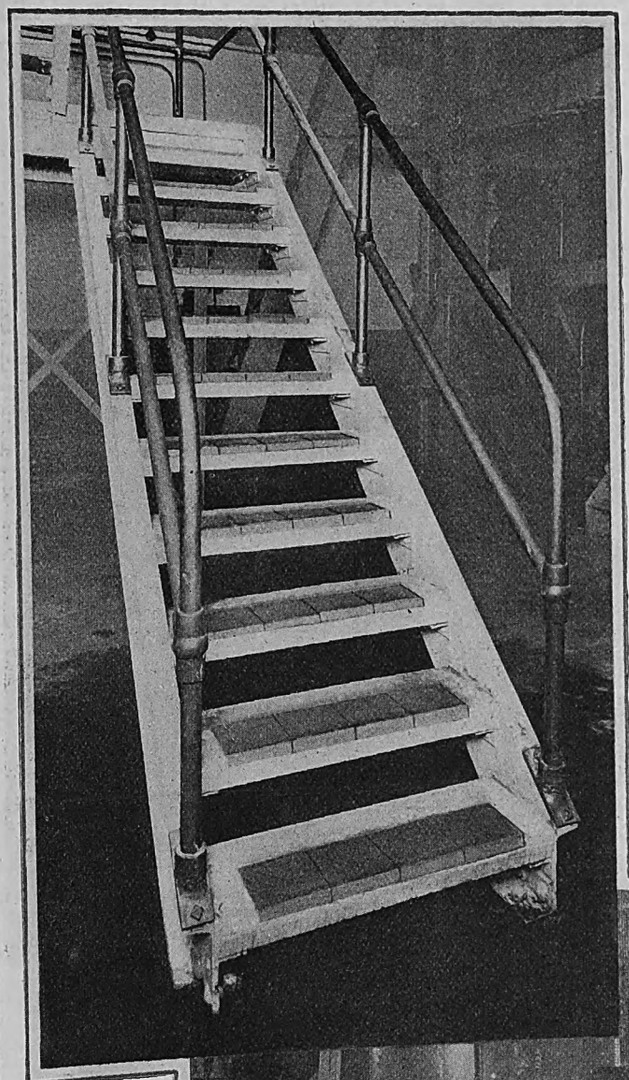
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Oil, grease or water do not destroy their slip-proof effectiveness.

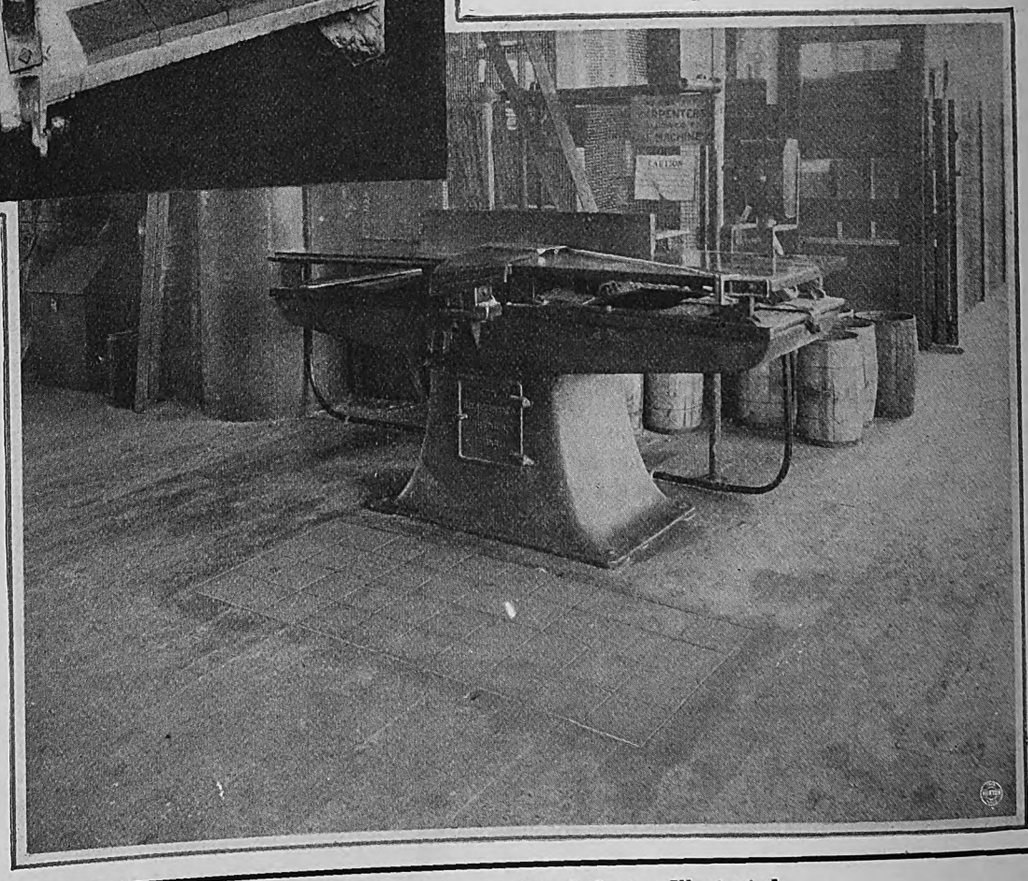
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(*Continued from page* 41)

these tunnels under mountains ranging from one mile to a mile and three-quarters above sea level, are as great as those met with in the construction of the Panama Canal, which has a total length of fifty miles.

A general sketch of the method of procedure will reveal the practical manner in which the work is undertaken and carried through.

The first step in the location of a tunnel is the projection of the proposed tunnel on the government survey map, which gives the surface topography by contour lines. Especial care is given to securing the necessary overhead and side cover of rock, so that the static forces of water will not cause a blowout. After this projection is made, a reconnaissance of the territory is made as a check upon the work of the government topographers. This shows that the projected location is approximately correct.

Next, a very close survey of the lines must be made, since in order to complete the construction work in the shortest time it is necessary to start simultaneously at each end, and these two ends must absolutely come together at their junction point. To accomplish this, the ordinary transit is abandoned and the engineer's theodolite, an instrument of utmost precision, is used. When it is realized that all this must be done in a wild, mountainous region, across rocky cliffs, through heavy timber where the elevation varies from 7,000 to 9,500 feet, one can appreciate the obstacles encountered and the exactness of the work required to achieve infallibility.

The art of tunnel drilling has advanced materially since the old days of the hand drill and the sledge hammer. Now it is done with pneumatic drills driven by air compressed by electrically driven machinery. The drills vary in length from six to twenty-one feet; the drill "steels" are an inch and a quarter in diameter with a bit at the end somewhat larger. Through their center is a bore, through which a continual flow of water is forced, keeping it cool while whirling at a steady rapid rate, striking the rock.

What is known as the "heading" and "bench" method is the one employed, the workmen standing on the bench, or lower half, while drilling into the heading, or upper half. The drill holes in the heading are arranged into four sets, in vertical rows. The inmost set converge, the next two sets cut slightly toward the center, while the outmost set, which circle the rim of the tunnel, cut slightly outward. The blasts are fired by an electric control which discharges the holes in the order given, first the inmost set and so on in succession until the rim holes are fired. Then, by hand labor and steam shovel, the muck is carried from the heading.

When two headings have been advanced approximately ten feet, then the bench is blown. This is done by drilling twenty-foot holes at the base of the tunnel, known as lifters, which blows up the bench. Steam shovels and trolley cars carry the muck from the bench, after which the process is started again.

In the driving of these tunnels it was found that there was no drill manufactured which was capable of drilling to the depth required. So one of the leading machine drill manufacturers developed a drill specially fitted for this work. After having been installed by experts, and explained to the operators, the drillers were enabled to cut down the time required to drill around the holes from one to two hours. Several other new departures have

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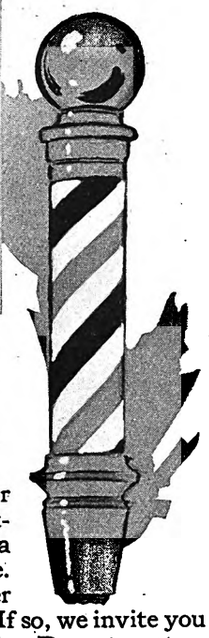
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PERHAPS you, like the inventor and manufacturer of the animated barber pole, are developing a motor driven novelty, tool or appliance. It may be, too, that a perplexing power problem is handicapping its success. If so, we invite you to utilize the services of our Engineering Department.

This department, for many years closely in contact with the uses of small motors, is accustomed to adapting fractional horsepower motors to "new fangled" applications. And to those manufacturers, who anticipate a change in the power unit they are now using, the advice of these motor experts will be especially valuable. Write them any time.

Dumore motors—dynamically balanced, operate quietly, without vibration. Bearing trouble is thus eliminated—long, carefree service assured. Operating on alternating or direct current, Dumore high speed motors are exceptionally adaptable. These special features qualify Dumore motors as the logical choice of manufacturers who require high speed power units for the products they make. Scores of manufacturers of motor driven tools, novelties and appliances, have found in Dumore motors a satisfactory solution of their power problems. Why not investigate and learn what these sturdy motors can do for you?

WISCONSIN ELECTRIC COMPANY
7000 Sixteenth Street Racine, Wisconsin



Type-SAX
⅛ h.p. motor with special base. Nickel plated. Operates on A. C. or D. C.

Type-A—Stripped
⅛ h.p. Cast iron frame, enamel finish, Babbitt bearings, wick oil feed operates on A.C. or D.C.





Type-D
⅛ h. p. Cast iron frame. Enamel finish. Plain bearings. Grease cups. Operates on A.C. or D.C.

No. 3GM—Stripped
¼ h. p. Aluminum frame. Enamel finish. Norma Bearings. Ventilated. Operates on A. C. or D. C.



Dumore
Fractional H.P. Motors

been made in the art of tunnel driving which have aided the progress of the work and added to this branch of technical science. Investigations and experiments in tunnel boring have not as yet proved success for this work. In this, the attempt is made to grind the entire bore in the tunnel, instead of blasting; the debris from the heading being washed out, instead of mucked out of the tunnel.

Close to the portal of each tunnel entrance and adit is the drill sharpening shop. The drill sharpening furnaces are operated by electric motor-driven air compressors. It is necessary to pass four hundred pieces of steel, varying in length from three to twenty-two feet, through the furnace and sharpener for each round in the tunnel. This is the Bessemer steel process in miniature.

The Southern California Edison Company is the largest consumer of high explosives of any organization in the world engaged in the same class of work. The chemical engineers of the powder companies have developed for this company a special grade of gelatine powder, notable for the small amount of fumes and gases it generates, thereby enabling the miners to get back into the tunnels after a blast in the minimum length of time. They have also developed a special size of cartridge, which will result in a more efficient shattering of the rock.

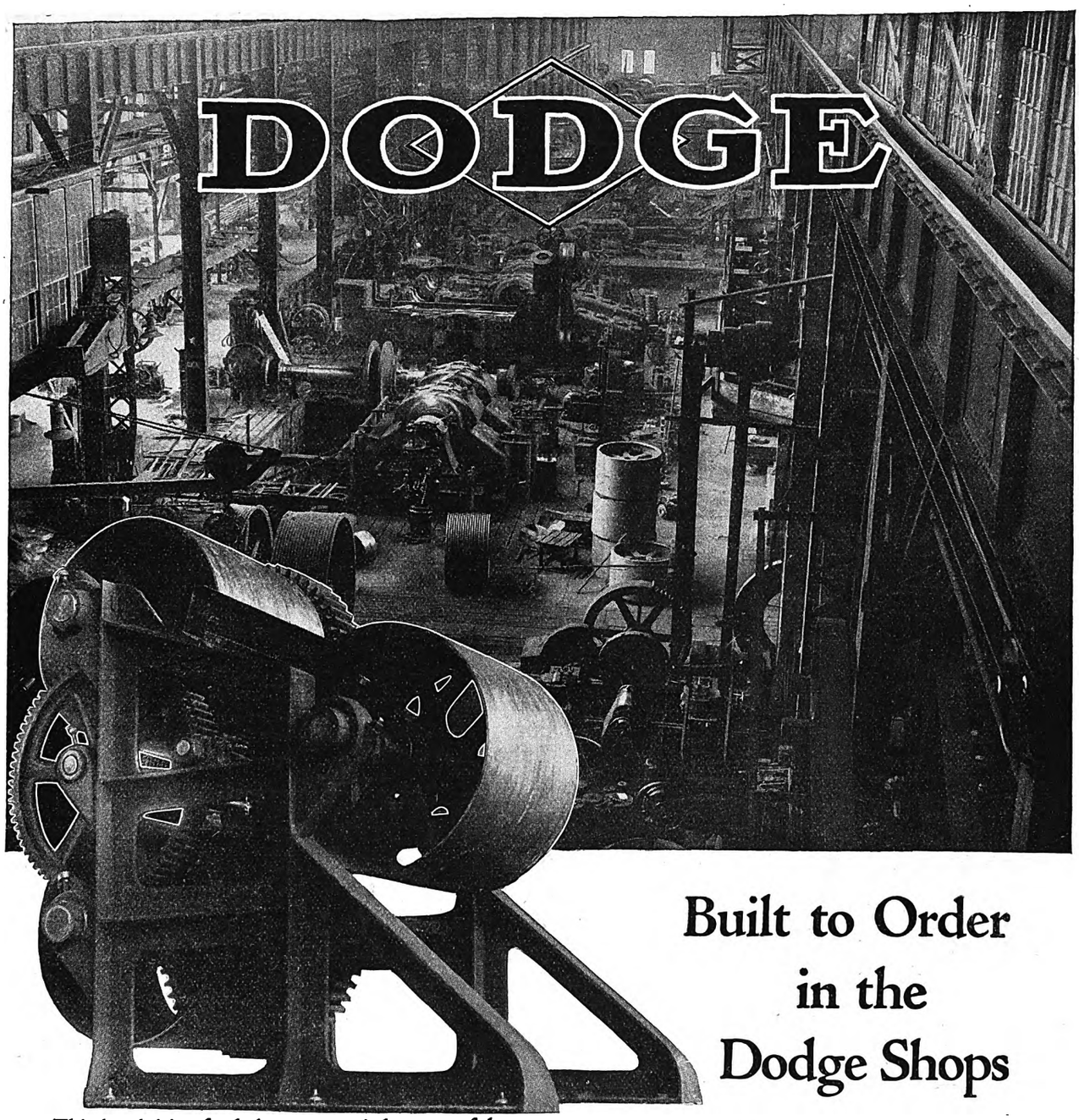
Approximately 5,330,000 pounds of powder have been used on the Big Creek project within the past twelve months; in the construction of Big Creek No. 3 alone 4,650,000 pounds were used. Near the portals and adits are the daily supply powder houses, and far back in the forests and on roadsides are located the seasonal powder houses, where sufficient powder is stored to carry on the work for the entire winter period.

World tunnel records have been made on this job, one of the most noteworthy being (on) the tunnel from the third powerhouse on the stream to the fourth. This tunnel has a cross section of twenty by twenty feet, is six miles long, and is hewn out of solid granite the entire distance, making it one of the largest hydro-electric tunnels in the world. The world's record made on this tunnel was in 1922, when 476 feet were driven from the heading in one month. Another wonderful record was made on the tunnel between Shaver Lake and Powerhouse No. 2, in 1921. This tunnel has a cross section eight by eleven feet and a distance of 522 feet was driven in one month. In Tunnel No. 6, the famous thirteen mile bore from Florence Lake to Huntington Lake, the remarkable distance of 125 feet was driven in one week.

The Florence Lake Tunnel, the second longest tunnel in the world, was started in 1920 and is now one-third completed; it will be finished in the Fall of 1925. It reaches from Florence Lake, at an elevation of 7,300 feet, under the Kaiser Range to Huntington Lake, at an altitude of 7,000 feet. Work is under way at the intake portal, where 2,300 feet have been drilled; at a lateral construction entrance (adit) about four and one-half miles below the intake, where the east heading has progressed 2,100 feet and the west heading 300 feet; and at another adit two and a half miles below, where the east heading, recently started, has been driven 350 feet and the west heading 9,600 feet; also at the outlet portal at Huntington Lake, six and one-half miles southwesterly, where the drillers are now working at a distance of 9,550 feet in from the portal. These distances are as of Sep-

(*Continued on page 47*)

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Complete piercing mills, rolling mill equipment, plate glass polishing tables, crushers, rope drives and other heavy machinery for all industries can be handled economically and with assurance of complete operating satisfaction.

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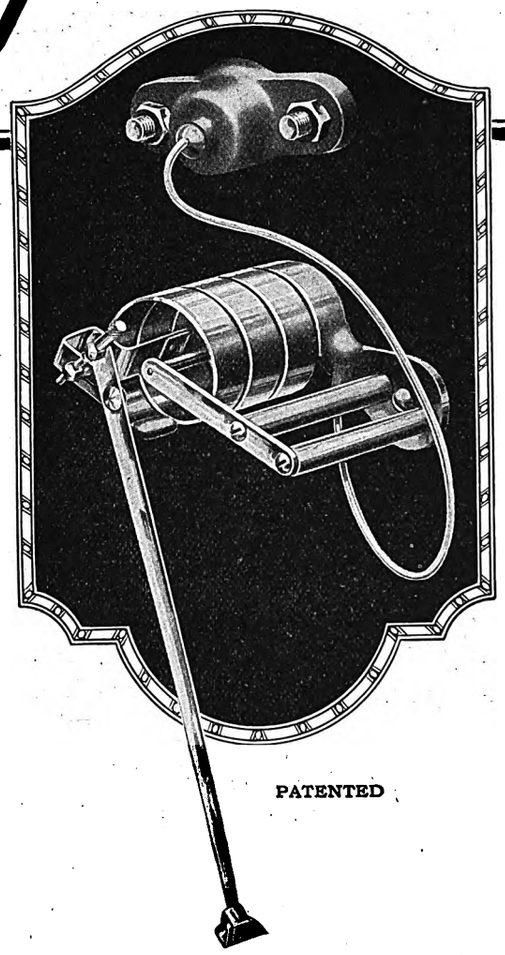
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THE COMPASS OF INDUSTRY

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(*Continued from page* 44)

tember 1, 1923. The average progress per day is twelve and a half feet per heading; the maximum amount driven during one day in any heading, working three shifts a day, is twenty-five feet.

Transmitting 220,000 volts of electricity from Big Creek to the suburbs of Los Angeles, a distance of 270 miles, marks the world's highest voltage record for commercial purposes. The line was first energized at this voltage on May 6, 1923, although originally constructed in 1913 for 150,000 volts, also a world's record at that time. The air surrounding the insulators breaks down under such high voltage, so it was necessary to install aluminum steel rings, and also to increase the clearance of the conductors from the ground and install additional insulators.

The changing of voltage effected a saving of $7,000,000 as against two additional lines of 150,000 volts, which would otherwise have been necessary. Under laboratory conditions, the electrical men are now experimenting with electricity at one million volts.

At the time the Huntington Lake Dams were built and the first two powerhouses constructed, in 1912, automobile trucks were in the experimental stage and horses and mules were used for all heavy hauling. It is said the cost of hauling these materials by live stock exceeded the entire cost of building and equipping the San Joaquin and Eastern Railroad, which was built primarily for carrying material and workmen to the job. A world's record was made in the construction of 56 miles of standard gauge railway over the roughest type of mountain country and in high altitudes, when this road was completed on July 10, 1912, in six months' time.

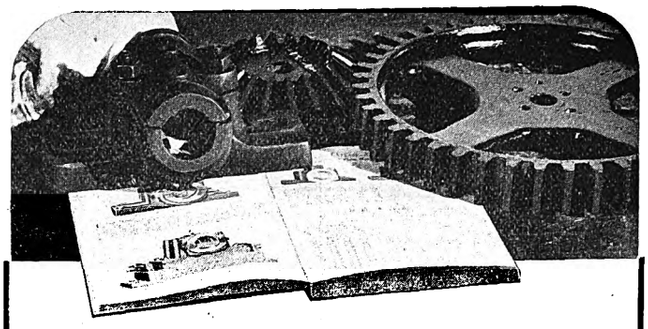
On the mountain division the curves are so sharp that the drive shaft locomotive cannot be used upon it, so the power is supplied by a gear type engine, with an upright drive, somewhat similar to the engine of an automobile. These powerful little locomotives can haul tremendous loads, but cannot attain a speed of over fifteen miles; they have been nicknamed the "galloping geese." The maximum grade on the mountain division is 5½ per cent.

During the brief open season from June 1 to October 15, the automobile fleet of twenty-two trucks must haul all the provisions, powder, cement, coke and coal, drill steel, railroad iron, electrical equipment,—all materials for construction work on the tunnels and maintenance of the construction camps. For the season of 1923-24, 18,000 tons will cross over Kaiser Range to the intake portal of Florence Lake, a distance of thirty miles, and intermediate points.

Jerry Dwyer, an old Alaskan "sour dough," with his seven trained team dogs and sledge, has made daily trips across Kaiser Range to the marooned tunnel workers since 1920. These men must go into voluntary exile for months, and in order that they be not entirley cut off from the world the Edison Company sent to Alaska for Jerry and his team. Carrying books and letters from the outside, they break their way through snow drifts from 20 to 30 feet deep in face of blizzards keener than ever swept the Yukon.

The natural grandeur of this region, the snow-covered peaks, rugged cliffs, sparkling cataracts running through the heavy timber, the green glades of the meadows, all make this section one of unparalleled magnificence.

(*Continued on page* 50)



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Medart Catalogue No. 43 includes tables for computing strength, horsepower capacities and sizes of shafting for various needs. Suggestions are made for the most advantageous use of couplings, hangers, bearings, clutches, pulleys, rope drives, etc. Rules are given for figuring gear speeds and diameters. These and many other facts make it a very valuable book. Well illustrated. Convenient pocket size.

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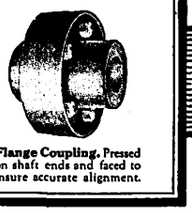
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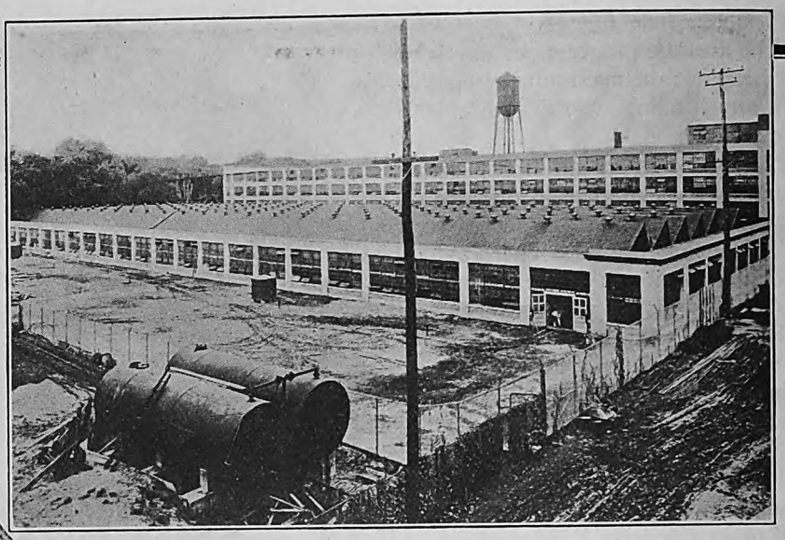


Flange Coupling. Pressed on shaft ends and faced to insure accurate alignment.

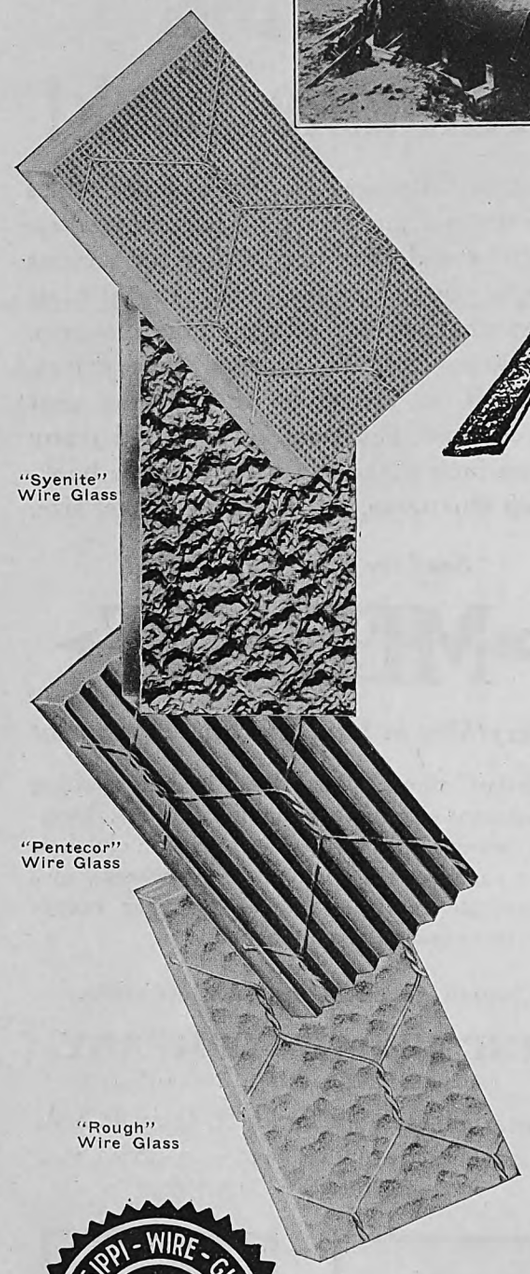


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Factrolite has been produced after years of research by the Mississippi Wire Glass Company engineers.

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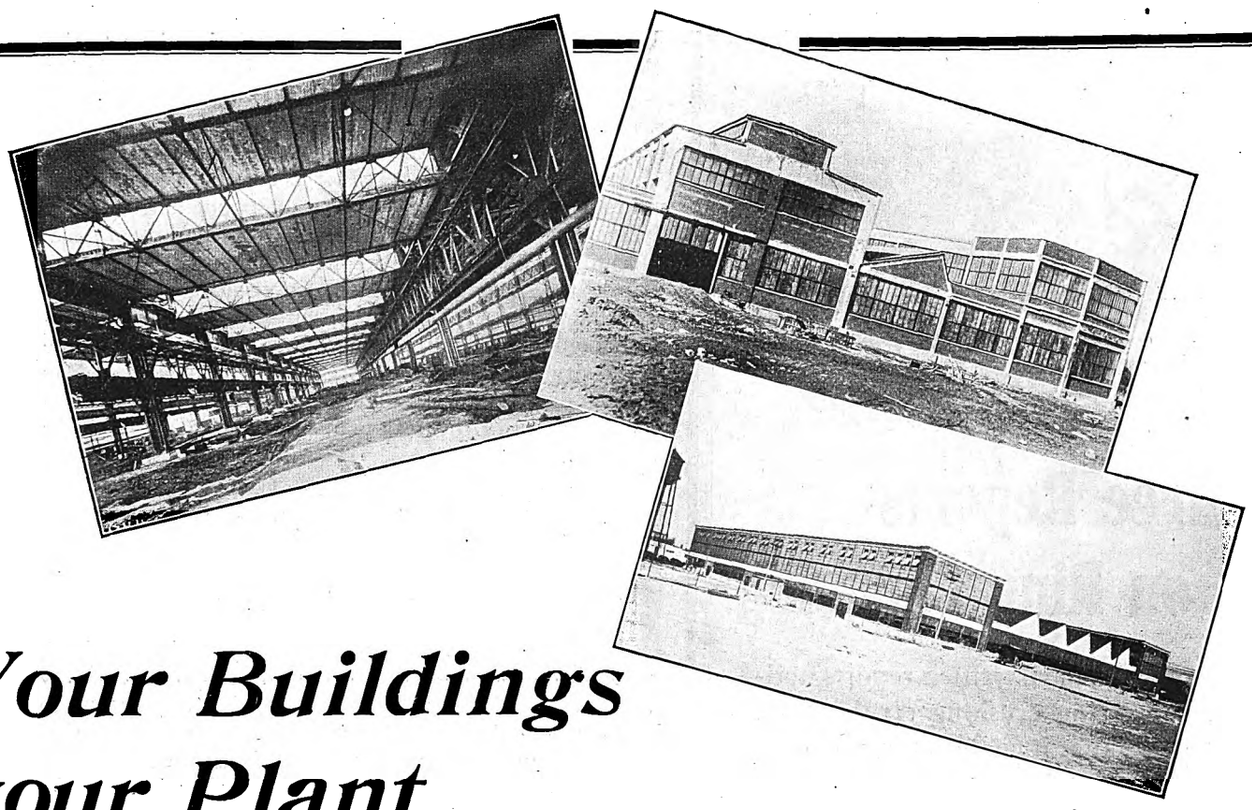
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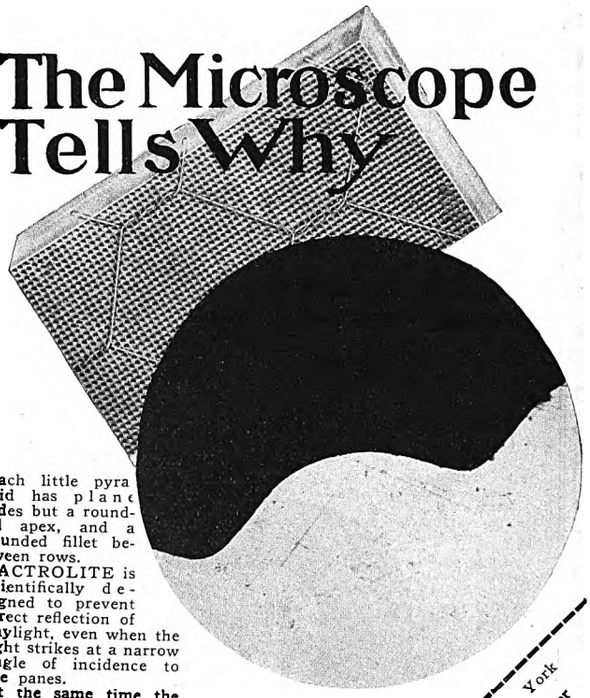
Every aim was directed to producing a glass which had the highest diffusing power and that gave the greatest daylighting power. That we have succeeded is proven by the thousands of Factrolite installations on sidewalls of modern plants.

Every square inch of Factrolite surface has 900 prisms that appear like tiny corrugations. Their shape, size and position have been scientifically determined to give ideal diffusion.

In addition we have had a number of tests made by the Electrical Testing Laboratories which should interest every executive interest in better lighting for increased production.

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The Microscope Tells Why



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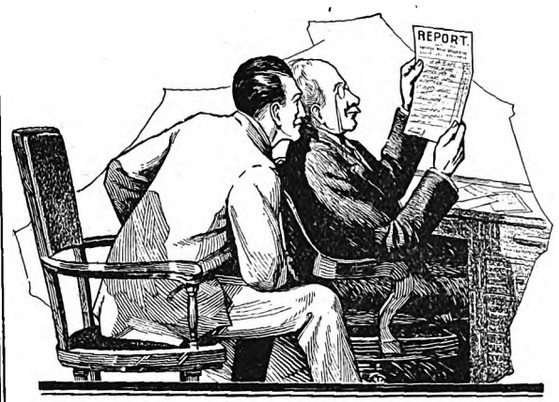
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American Pulverizing Co.
18th and Austin Sts., St. Louis, U. S. A.



AMERICAN Ring CRUSHERS

(*Continued from page* 47)

When this work is completed there will be given to the State and to nature lovers four beautiful mountain lakes, all within easy distance of each other. Huntington Lake is about five miles long and one mile at its widest point, and Huntington Lake Lodge, on its bank, is already a popular resort. Florence Lake, twenty-three miles distant by forest road, is about one-half its size, lying in a deep crevice between towering mountains. Vermillion Lake will be in the very heart of the most impressive mountain scenery in California. Shaver Lake, the largest of them all, with a water line of approximately fifty miles, will undoubtedly be one of the greatest pleasure resorts in the State. It is sheltered by surrounding mountains and is accessible for a much longer period of the year than the other lakes of higher altitudes.

These lakes will in coming years be a regular fishermen's paradise, for the State Fish and Game Commission has been stocking Huntington Lake and the streams tributary to the other lakes, with Loch Leven, Rainbow and Eastern Brook Trout, and will continue restocking all waters yearly.

The vast areas of timber in the San Joaquin-Big Creek watershed escaped the destruction of forests which many States suffered during the latter eighties, largely due to the fact that this district was at that time remote from the great lumber markets and far from transportation. Had the Sierra Forests been stripped of their trees, the precipitation from rain and melting snows would have rushed from the mountainsides in devastating floods, and there could have been no lateral irrigation and no hydro-electric power for Central and Southern California. But this area was withdrawn by the Government before any serious inroads could be made, and all tree-cutting is now directed by the forest ranger service, the rangers marking all mature trees every year.

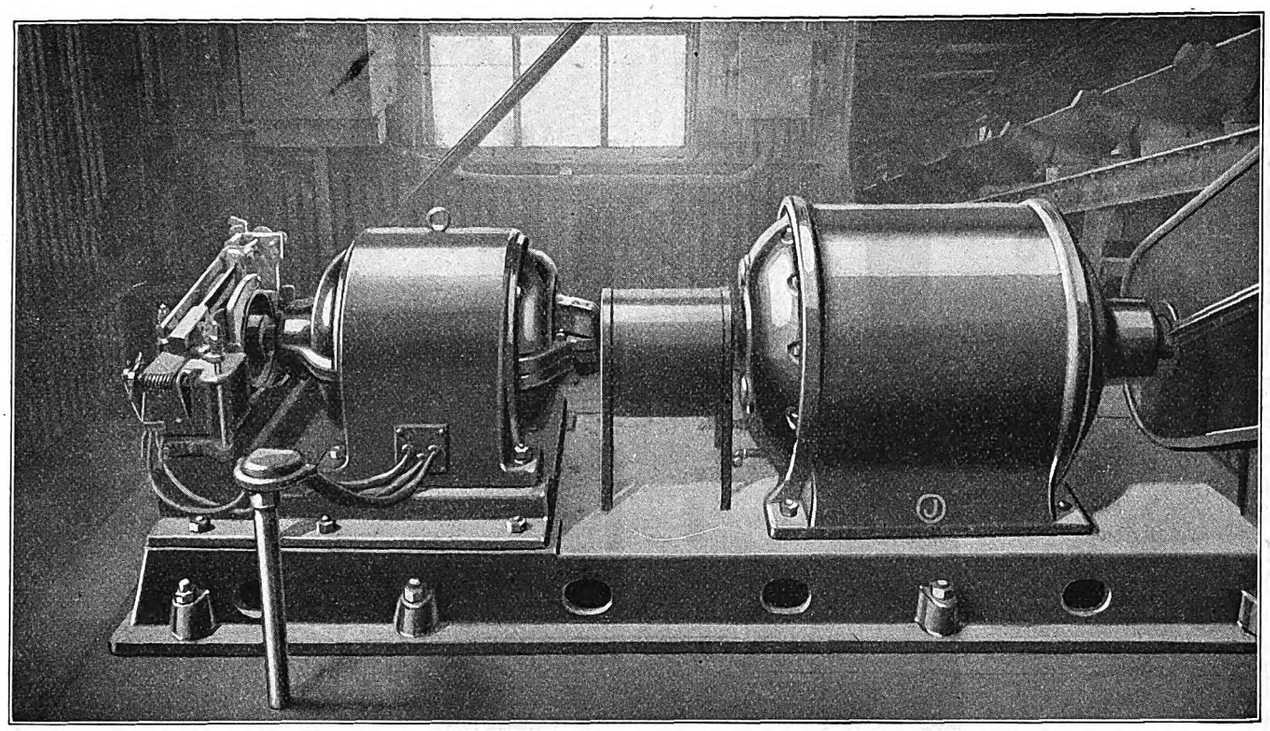
Permanent camps are located above the snow line, where extremely cold weather obtains. They are storm proof, heated with wood stoves, and make very comfortable living quarters. Along Florence Lake Tunnel, where the four headings are being driven, there are four of the five hundred-men camps. At the crest of Kaiser Range is a camp permanently intended as a shelter camp for the men or animals who are forced to take refuge from the severe storms and blizzards which sweep across its heights. At this camp, 9,300 feet above sea level, is located the world's highest radio station. There are also three large transfer camps for handling and transferring freight.

Cascada, the terminal of the San Joaquin and Eastern Railroad, started as a construction camp, and is now a thoroughly equipped municipality with a population of over 1,400. The headquarters of the project, administration building, accounting department, warehouse, general store, shops, garage, are located here. The city is complete in other respects, having a regular city government, grammar school, stores, as well as permanent homes for the engineers, department heads and operators of the powerhouses, recreation halls, and dormitories for the single men.

Temporary canvas tents are pitched in the warmer sections and follow the path of construction. Though often built almost on the sides of cliffs, water is piped to these tent cities and every attention given to comfort and

(*Continued on page* 53)

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A Jones Speed Reducer driving an inclined belt conveyor in a By-Products Coke plant. Motor speed 860 R. P. M.—Final speed 21.5 R. P. M.—Reduction ratio 40 to 1.

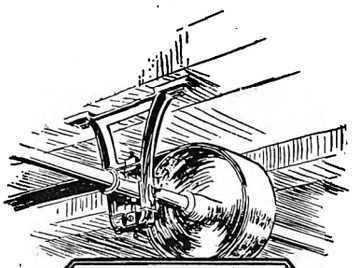
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(*Continued from page* 50)

cleanliness. They consist of dining room, club room, baths and sleeping cabins. As an illustration of the perfection of sanitation, the Company furnishes all the bedding, which is regularly cleaned, and after being used by one man, is fumigated and laundered before being given to another.

Providing meals for the five to seven thousand men engaged in vigorous labor requires eighteen cook houses and a large staff of cooks, bakers and roustabouts. To give some idea of the amount of food consumed in one month, there is needed 55,000 loaves of bread, 5,000 cakes, 36,000 pies, 210,000 pounds of potatoes and 219,000 pounds of meat.

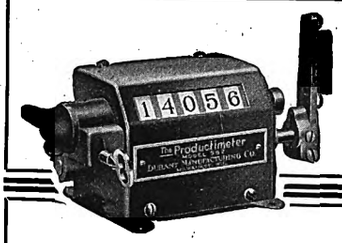
The medical corps has operated most efficiently in caring for the men, for in these camps the sickness and death rate has for years been far below normal, even during the influenza epidemic. There are three medical divisions, each having a principal hospital in charge of a physician and his assistants with emergency and dressing stations at each camp under the care of resident nurses.

As in all great enterprises that have a mighty achievement for a goal, coöperation has been, from the outset, the dominating feature in the actual development work. The construction army is organized very much on the lines of a regular army, and directed by men who have grown up with the job. All applicants are carefully selected and subjected to physical examination before entering the service. Advancement depends entirely on ability and loyalty, and many men have gradually worked themselves up to positions of great responsibility. Lectures on practical problems, educational courses in electrical subjects, and a circulating library providing information on technical details, encourage the men to perfect themselves in their profession and to look upon it as a life work.

Good living conditions, excellent food, commissary stores, amusements, all go to make for contentment and efficiency; and the keen zest of open-air work, and knowledge that they are playing a part in the accomplishment of this huge physical undertaking, have created a spirit of camaraderie among the men which is in no small degree accountable for the very small monthly turnover in labor. It is said that the record of labor turnover on most of the big projects comparable to this one have averaged as high as 100 per cent. per month. But under the plan of permanent organization, the labor turnover on this work has been constantly decreasing, until the average for the last year was 40 per cent., and the lowest average for any month 25 per cent.

Another factor which has greatly stimulated the employees to increased effort and the desire to eliminate small wastes, is the stock selling program whereby employees can purchase stock on a monthly basis, and thus consider themselves partners in the enterprise. Taking the organization as a whole, executive, operating, commercial and accounting, about 98 per cent. of the men and women of the Edison system are participating partners, and this tendency is spreading among the construction men as they see their work before them for the next ten or twelve years.

As a result of this concerted effort, and in recognition of the progressive spirit which the Company has displayed, the Southern California Edison Company was awarded the Charles A. Coffin medal for "the greatest



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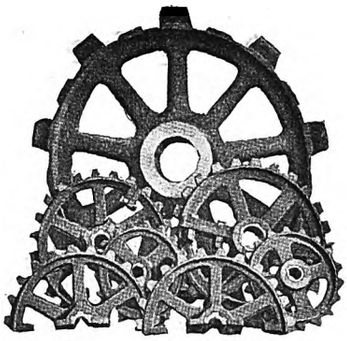
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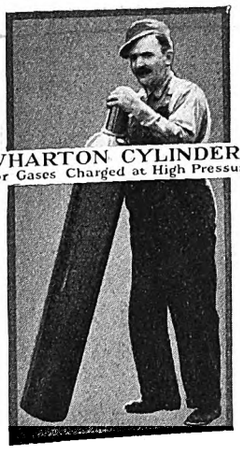


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Recognized as the standard in manganese steel. Records of its performances show durability from five to fifteen times as long as malleable iron.

Bulletin 113-J embraces complete description of these products with illustrations of the various types.

Taylor-Wharton Iron & Steel Co.
High Bridge, N. J.



Made From Wharton Special Cylinder Steel Billets

Six exacting inspections during manufacture, and a final hydrostatic test.

Delivered promptly, complete, with or without caps and valves.

For oxygen, acetylene, hydrogen, carbonic acid, nitrous oxide, sulphur dioxide, liquid chlorine, blaugas, etc.

Manufactured rigidly to standard British and American specifications, with safety and endurance factors beyond requirements.

Wm. Wharton Jr. & Co., Inc.
30 Church Street
N. Y. City

Products of the Allied Companies—Catalogs on request

Manganese Steel, Manganese Wearing Parts, Special Track Work, Cylinders for Gases, Hammered and Pressed Forgings, Rolls and Rolling Mill Machinery

contribution to the development of electric light and power for the convenience of the public and the benefit of the industry for the year 1922." This is the first annual award of the medal, to which all public utility companies in the United States were invited to compete. The points considered are: Outstanding technical achievements, improvements in service methods, extension of lines into new territory, relations with consumers and advance in the plan of consumer partnership. In addition to the medal, the sum of one thousand dollars is contributed for the benefit of company employees.

Development work on this great project is thus moving steadily onward, meeting the power requirements of this remarkable section of our country, and aiding materially in its growth. In 1935 the ultimate capacity will have been attained, generating sufficient electrical energy for a population of 5,500,000.

FINANCIAL and business circles recently have been stirred by the revival of the old question as to who stands the loss, the maker of a check or the bank, in the event of loss from check fraud. The interest in this question has been aroused by articles which contribute nothing toward its solution, but merely add to the literature of controversy. It is said that the salesmen of check-writer manufacturers are quite generally stating that the maker is responsible for the loss, whereas the other group argue that the bank is responsible. Each side cites cases to prove its point.

Probably as many court decisions have been rendered on one side as on the other. Unfortunately no body of law has as yet been built upon such precedents, and as there is no uniformity in state laws in the matter of liability it may be that a Federal statute may be required to cover the whole question. Decisions, for the most part, are rendered by juries on the basis of the individual circumstances attending each case.

The only certain guiding points in the laws governing such cases are that the burden of proof that a check actually has been altered as claimed, rests upon the maker, that the bank was negligent in paying such check, and that the blame for loss on a forged or altered check rests upon the one who was "negligent." Against the operations of skilled forgers it is usually very difficult to establish satisfactory proof of forgery or alteration, unless the mechanical protection afforded the check has been such as to make his work so obvious that acceptance of the check by the bank was palpable negligence.

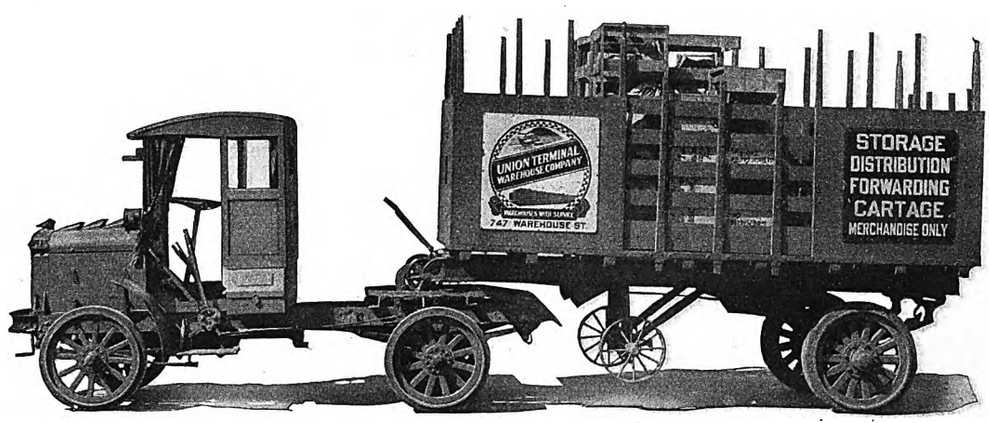
The question of responsibility, it would seem to the business observer as a matter of sound practice, is merely incidental. The real issue is whether or not steps to prevent losses from check fraud are worth while, and experience would seem to indicate that they are very much worth while. Check protector manufacturers sell machines today which shred the amount in two colors, and make alteration impossible. This automatically removes one of the commonest forms of check fraud—namely, the raised check.

In the face of numerous safeguards it would seem that the modern business man can so protect his negotiable instruments that possibility of lawsuit is largely removed, and, in addition, the business man has taken a long step toward removing the temptation from his employees and others toward the commission of check fraud.

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Applying Advanced Methods to Hauling by Motor

for increased service and reduced cost



One of the scores of users of

LAPEER SEMI-TRAILERS

"The Maximum Motor Method"

Combining

Trebled hauling capacity of the power unit!
Reduction of hauling cost to one-third!
Elimination of lost time during loading and unloading!
Complete control of trailer from the tractor cab!

You Will Be Interested In This Folder!

We have just published a folder showing in photographic detail the many remarkable mechanical features of Lapeer Semi-Trailers. We shall be pleased to send you one.

Write for Folder No. I-101

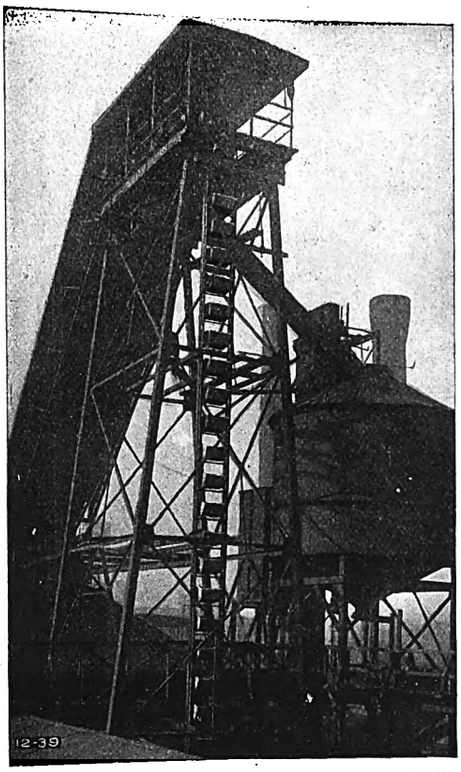
LAPEER TRAILER CORPORATION
LAPEER, MICHIGAN

FACTORY BRANCHES: NEW YORK—PHILADELPHIA—BOSTON—DETROIT

DISTRIBUTORS: CLEVELAND—CHICAGO—ST. LOUIS—BUFFALO—LOS ANGELES—NEW ORLEANS—MILWAUKEE—TORONTO

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The Future of the Business



Here is an installation in Plant "B," Detroit City Gas Co., that has proven profitable to its owners and admirably suits their particular requirements.

Coal is elevated by a Hunt Pivoted Bucket Conveyor and discharged through a chute into tank shown at the right, from which it is loaded into Hunt Industrial Cars and taken to storage bins.

WE DESIGN AND BUILD:

Industrial Railways, Automatic Railways, Cable Railways, Cars, Tracks, Switches, Motor Cars, Scales, Conveyors, Skip Hoists, Electric Vibrating Screens, Cut-Off Valves, or Gates, Weighing and Measuring Devices, Coal Crackers, "Stevedore" Transmission Rope and Hoisting Rope.

What hopes and fears are conjured up in the mind of the industrial executive, when contemplating this all-absorbing problem.

In retrospect he visions the humble start; the heart-breaking efforts "to get the business on its feet." Then the steady expansion; until that never-to-be-forgotten day, when he could direct, from his own private office, the management of the business to which he had given his best years.

As he reviews the past, he notes the gradual transition from laborious manual labor to his present machine equipment. And realizes it is to his foresightedness in this respect that success was accomplished.

The white-haired executive will remember how every industry welcomed the result of C. W. Hunt's inventive genius over half a century ago, when he placed his pivoted bucket conveyor on the market.

Here was an invention destined to revolutionize the handling of coal and ashes, and similar bulk material. To make it less laborious, to do it more efficiently in the shortest time and at a substantial reduction in cost. He knew the savings made in this operation added to his profit and aided in volume production.

For this reason he,—and his successors,—have a kindly feeling for Hunt Cost-Cutting Equipment. It has truly borne out its name and cut costs wherever installed.

Let Hunt Engineers plan for the present generation of industrial executives, a system of coal, ashes and bulk materials handling, that in years to come will reflect the wisdom of their predecessors.

C. W. HUNT COMPANY, Inc.

West New Brighton, New York City

NEW YORK OFFICE—Whitehall Building

PHILLIPS, LANG & CO., Inc.,
431 South Dearborn St., Chicago, Ill.

ERNEST F. LEARNED,
141 Milk Street, Boston 9, Mass.

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The Versatile Industrial Crane

(*Continued from page* 33)

and equipped with two trolleys and hooks is shown in Fig. 20 operating in a building where heavy machinery is installed. When used in this capacity or in power houses, the crane eliminates entirely the necessity of heavy lifting. The services of the crane in these installations has a great effect on the low cost of repairing, overhauling, and installing manufacturing equipment. The savings are brought about in many ways. First, they save days of time; second, they eliminate a number of extra men that would otherwise be required to erect rigging, scaffolding, etc. Thus the crane simplifies handling, cuts down labor costs, and speeds up the work. These simple and even the more expensive cranes, when employed in like manner have frequently paid for themselves by savings effected in one overhauling or the installation of equipment.

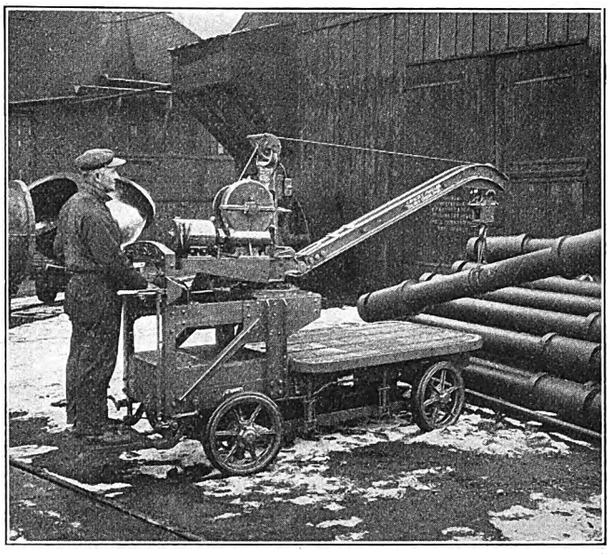
Electric overhead traveling cranes of medium and heavy capacities are generally equipped with an operator's cab suspended from the bridge either at one end, or sometimes in the center as shown in Fig. 18. The various switches, controllers, etc., are installed in the cab within easy reach of the operator. Because the operator is so high or removed from the working floor in this type of crane it is well to adopt proper rules and regulations for signals, etc., so as to eliminate accidents. It is not only necessary to educate the crane operator in the proper use of these signals but the workmen about the building served by the crane should also be instructed and compelled to obey them. A code of safety standards for cranes has been prepared by the American Society of Mechanical Engineers Sub-Committee on the Protection of Industrial Workers, which should be studied by the plant safety man and adopted wherever cranes are used.

Fig. 23 shows a shop well arranged for the use of a traveling crane, and the necessity for proper signals in its operation should be apparent. It will be noted that the balconies on the second floor extend beyond the crane tracks. This permits loads to be deposited directly on the second floor from the crane hook without rehandling. Attention is directed to the crane runway and its relation to the center of the building which permits maximum service. The construction of the building being of wood it was necessary to provide additional columns for supporting the crane track, but in the case of steel buildings the crane columns and building columns are one as shown in the other illustrations.

The layout of crane bays is an important factor in the proper operation of the equipment and for general manufacturing buildings, chemicals, plants and process buildings of more than one floor, the layout as shown in Fig. 23 will be found best adapted to the crane needs. In the case of warehouses, foundries, locomotive works, shipyards, etc., the crane bays and runways as shown in Figs. 18, 19, 22, 24, 26 and 27 will be found more advantageous.

Most steel mill cranes are special, but related industries such as steel warehouses, structural shops and rolling mills can use standard equipment. Fig. 24 shows a cab-operated overhead traveling crane installed in the warehouse of the Colburn Machine Tool Company, Cleveland, Ohio. Here flat steel, steel shapes, cold rolled

(*Continued on page* 61)

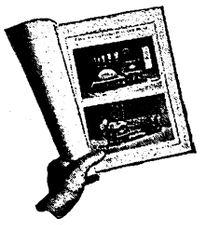


The "Handy Man" of the Shop

WHILE every type of Crescent Electric Industrial Truck is designed to overcome a specific transportation problem, it is also true that each type can be used for a variety of operations within its scope.

The uses to which the Crescent Crane Truck shown above can be put are self suggestive. For piling, carrying, moving, lifting heavy or unwieldy objects, it is ideal. Like all Crescent Trucks, it can operate within a narrow radius; it is built with an eye to superior workmanship and a knowledge of the conditions it meets in every day service.

Our engineers will be glad to call and help you solve your carrying problems —without obligation on your part.



Where Shall We Send Your copy of Our Catalog?

CRESCENT TRUCK CO.

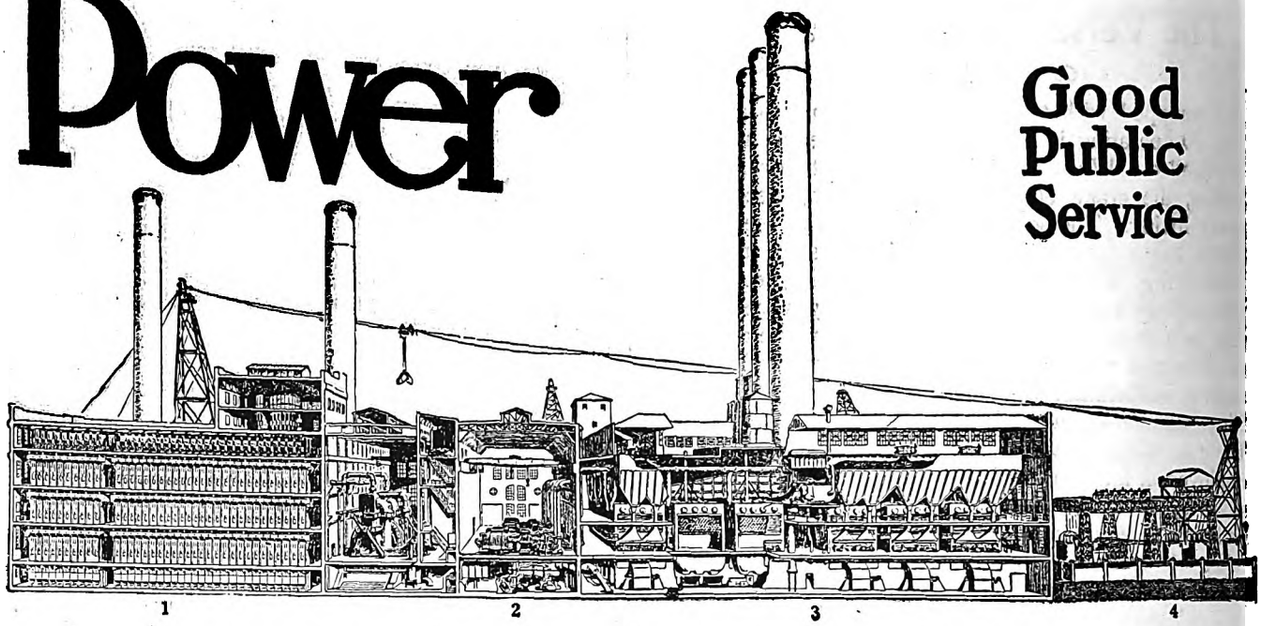
165 North 10th Street

LEBANON - - - PA.

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Power

Good Public Service



1 2 3 4

A section through the Westport station, showing: 1—Switch House; 2—Main Turbine Room, where seven turbines generate 166,000 H. P.; 3—Boiler Room, showing a few of the 40 Edge Moor Boilers in service; 4—Outdoor Substation.

WESTPORT—

Baltimore's Central Station Operates 40 Edge Moor Boilers

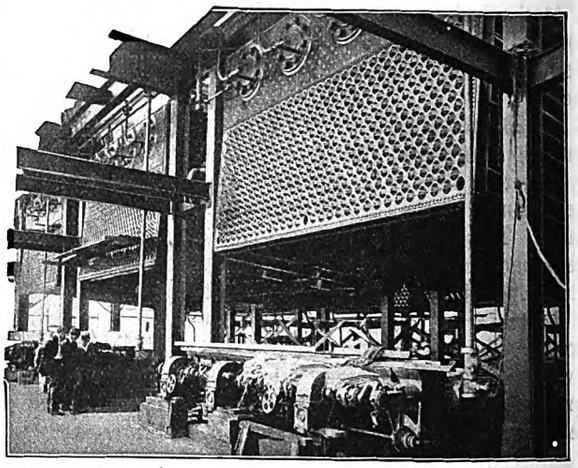
TO supply the power and light needs of the Seventh City is a task requiring efficient management and dependable equipment. The Westport station of the Consolidated Gas, Electric Light and Power Company has both.

The progressive character of the Consolidated management is indicated by its extensive advertising campaign, impressing upon Baltimoreans the value of good public service.

Forty Edge Moor Boilers totalling more than 40,000 H.P. supply the steam used by seven great turbines in generating Baltimore's electricity.

Executives of other progressive plants will find much of interest in the Edge Moor catalogue—sent free upon request.

Below are shown three 1049 H. P. Edge Moor Boilers during erection at Westport.



EDGE MOOR IRON COMPANY

Established 1868

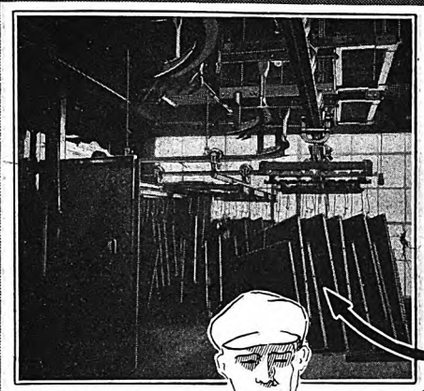
EDGE MOOR, DELAWARE

New York Chicago St. Paul Boston Pittsburgh Charlotte

EDGE MOOR Water Tube BOILERS

FOR INCREASED FUEL ECONOMY

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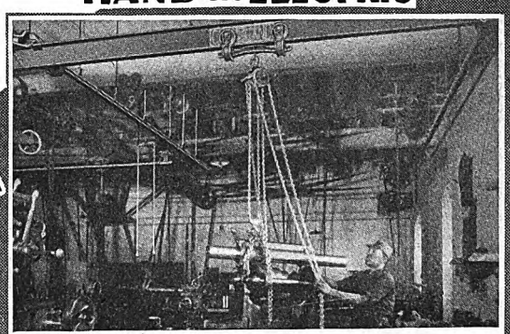


Removing carriers from ovens

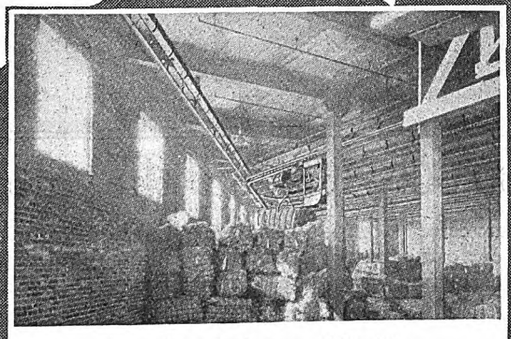
Gangway or Headway ?

Is it a small thing—
to allow monopoly or even partial monopoly of floor space, labor, and time by a corps of floor truckers.
The ceiling is the highway for headway in material handling when its purloins support a Cleveland Tramrail system which is absolutely flexible and adaptable to any and all conditions.
May we look over your plant and make our recommendations to you?

CLEVELAND TRAMRAILS
HAND OR ELECTRIC



Typical installation for any machine shop



Tramrail in stock room piling bales



Tramrail equipped with push button control shipping blocks in a wire mill

CLEVELAND ELECTRIC TRAMRAIL
MADE BY
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO.

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(*Continued from page 57*)

shafting and other steel parts are stored. Because of the unwieldy nature of the products and their weight, the crane equipment is the most efficient that could be installed. The use of racks permits the crane operator and one man to place the materials in or take them out of stock. Attention is directed to the high, light, airy building which makes for ideal crane operation.

Foundries are extensive users of electric and hand-operated overhead traveling cranes and the reasons for this are apparent if we look at Fig. 22 which shows how the foundry floors are cluttered up with miscellaneous flasks, castings, sand piles, etc. These conditions make it difficult to truck or move things on the floor, but as the crane moves above the floor it has a clear passage at all times and can quickly raise the load, transport it and lower it again without assistance or loss of time.

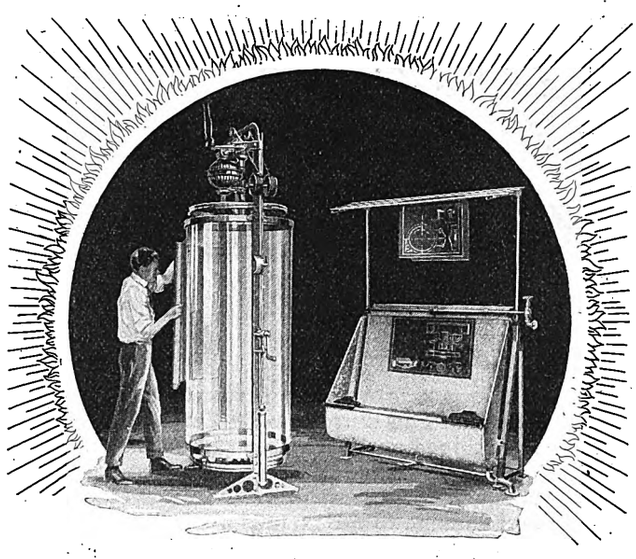
Many old foundries and other shops are doing without the services of overhead cranes because they feel that the cranes require too much headroom to fit into their old buildings. This is often true of standard cranes, but in such cases, for practically the same cost, special low cranes can be designed and installed. Fig. 19 shows such a crane in the plant of the U. S. High Speed Steel & Tool Co., at Troy, N. Y. This crane was designed primarily for use in an old low building where no provision had been made for crane service. This crane is a typical heavy duty steel mill design, built for the hardest service and yet when installed in a low building gives practically the same clearance under the crane hook as would be obtained if a standard crane were used, and the building were three or four feet higher. Though this crane has a 51-foot span it only requires 2 ft. 6 in. headroom and thus the crane hook when in its highest position is only 3 ft. 8 in. below the highest point of the crane.

Other industries have overlooked the possibilities of the crane because they feel that the span is more or less limited and that intermediate columns for crane runways would interfere with the proper movement of materials within the building, and would take up valuable floor space. Figs. 18 and 26 illustrate what can be done in the way of crane spans. Fig. 18 shows a 5-ton 97 ft. 6 in. span overhead electric traveling crane in the plant of the Bridgman Co., Philadelphia, used for the loading and unloading of cars. Fig. 26 shows a 125-ton 97-ft. 5½-in. span overhead electric traveling crane handling locomotives in the shops of the Chicago, Burlington & Quincy R. R. at Denver, Colo. While these illustrations show two extremes as to capacity, there is no difficulty in meeting requirements between these limits.

Overhead traveling cranes operating in shipyards have to be supported on specially built runways. Fig. 27 shows the cranes over one of the ways at the Bethlehem Shipbuilding Corporation, Fore River plant, Quincy, Mass. It will be noted that the cranes operate on tracks placed at two different heights. The longitudinal and transverse movement obtained by using this type of crane permits materials to be handled to any point in the ship way.

As previously stated one of the most common types of cranes is the locomotive traveling crane which is to the industrial plant yard what the overhead traveling crane is to the industrial plant building. Figs. 11, 12 and 16 show three different types of locomotive cranes, on as many different operations.

Fig. 11 shows a locomotive crane electrically operated,



The Eclipse of the Sun

As far as blue printing is concerned was a demise and took place when the Pease Vertical and Pease Peerless Blue Printing machines were invented. Nowadays sun printing is practically obsolete although there are a few blue print users who still depend on uncertain Old Sol.

Blue Prints at Low Cost

The Pease Vertical Blue Printing Machine and Sheet Washer and the Pease Peerless Equipment with their exclusive features have just about forced Old Sol into a total eclipse. The combination illustrated is an ideal equipment for the engineer and blue print user who requires a reasonable amount of blue prints at low cost with a moderate initial investment.

Blue Printing Machinery

Drawing Materials

Drafting Room Furniture and Supplies

Drawing Instruments

"Instructions for Making Blue Prints"

is the name of our new booklet which not only tells the complete story of the Pease Vertical but also explains in detail modern methods of producing blue prints.

Shall We Send A Copy?

The C. F. Pease Company
828 N. Franklin Street
Chicago, Illinois

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Zering No. 15 Built to Last



A truck is only as serviceable as its casters. This sturdily built Zering No. 15 is equipped with Champion Plate Casters. Bolster breakage is eliminated, costly repair and replacement bills are avoided, and damage to products is minimized.

The rails are tenoned, grooved and securely bolted to side rails. Heavier loads are handled with less effort. Made in all sizes. Write for complete information.

The H. Zering Manufacturing Co.

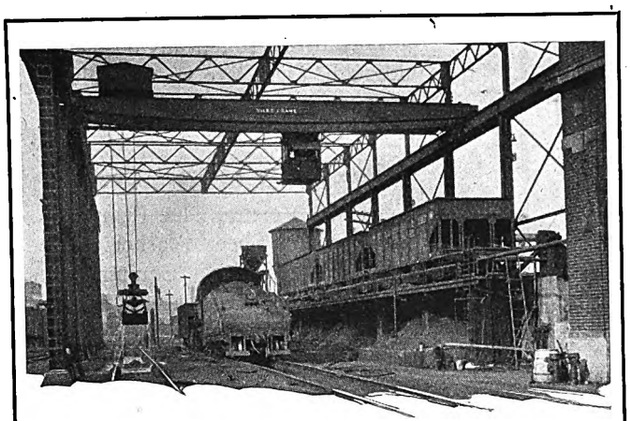
4425 Enyart St., Oakley Station, Cincinnati, Ohio



Patent Pending

Manufacturers of trucks, trailers, skids and casters.

Champion adjustable double race casters are used on all Zering ball bearing trucks.



NILES CRANES

Handling Ashes at Railroad Terminals

THE superiority of electric traveling cranes and grab buckets for speeding up and cutting the cost of handling and loading ashes at terminals has been demonstrated by some of the largest railroads of this country. Niles Cranes have done a large part in making such installations successful.

Their unusually rugged electrical equipment and husky lifting gear, their ease of handling, their reliability under severe outdoor conditions and under continuous service has splendidly equipped them for just such work.

Niles Cranes are made in all sizes from 5 to 250 tons and larger, and electric traveling, jib, wall, and gantry types. Built in a plant that makes cranes *exclusively* and that has twenty-five years experience in crane construction behind it to ensure highest quality.

Our Catalog will show you how to use Niles Cranes to save you money. Send for it.

NILES-BEMENT-POND CO. 111 BROADWAY NEW YORK CITY

CRANE WORKS — PHILADELPHIA

handling coal from storage pile to power house bunker. It is unusual to find this type of crane electrically operated, but if electricity can be obtained at reasonable cost there is no reason why such operation should not be both satisfactory and economical.

Fig. 16 illustrates the overhanging boom type of locomotive crane used for handling lumber in unit packages. This crane is steam operated, which is the usual method of obtaining power. These cranes are located at the Vart Hardwood Company and their record is as follows:

Two 18-ton overhanging boom cranes handle from 225,000 to 250,000 feet of lumber daily, using six men.

From 75,000 to 100,000 feet of lumber is handled from sorter to stacker.

From 15,000 to 30,000 feet of timber and ties from timber dock to loading dock.

From 50,000 to 75,000 feet of lumber from stacker to yard.

From 15,000 to 30,000 feet from kiln to loading shed.

From 50,000 to 75,000 feet from yard to loading shed.

It will readily be seen that these cranes play an important part in the final cost of lumber, as high handling costs would naturally make for higher finished product costs.

Fig. 12 shows a gasoline-driven locomotive crane mounted on a caterpillar tractor and operating on the dock of the Liberty Trucking Company at Staten Island, N. Y., on the operation of unloading barges. It is estimated that a 52-gallon barrel of gasoline will produce approximately two days' work with this machine. With a steam-drive locomotive crane of the same size it is estimated that one ton of coal would produce one day's work. Figuring gasoline at 20 cents per gallon and coal at $8 per ton the difference in fuel costs can be easily compared.

When using cranes it is necessary to pay attention to what is on the crane hook, in the form of a lifting medium, as it is to select the proper crane for the particular operation or building condition. Different types of lifting medium, such as magnets, grab buckets, slings and special devices are shown in Figs. 5, 13, 14, 15, 16, 26 and 32.

Fig. 5 presents a special sling designed to handle a roll or large object having a hole in the center. Fig. 13 shows the well known grab bucket with which we are all familiar. Fig. 14 shows a magnet handling steel shavings, the magnet can also be advantageously used for handling pipe, sheet iron and structural shapes. Fig. 15 shows a special grab device designed to handle ties and other loads of a similar nature. Fig. 16 shows special slings designed to handle lumber in unit packages to facilitate quick pick-up and placing. Fig. 26 shows special slings for handling locomotives; it will be noted that on the hook of each crane a different type of sling is required so as to properly pick up the load without twisting or straining. Fig. 32 illustrates what is known as a large capacity bucket for handling bulk materials.

To give the details of each crane operation and to describe in full the uses of each type would require many separate articles. For that reason descriptions are more or less meager, but the readers can obtain additional information if desired.

Cranes that are not as common as the above mentioned

(*Continued on page* 66)

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Today's fallacies were yesterday's facts

WHAT was fact yesterday is not necessarily true today. For example, Steam was once admittedly the most economical method of heating for all industrial buildings. In a certain type of building, and in some localities, its economy is still undisputed. But this no longer applies universally. Due to improved and more efficient engineering, hot water, in many types of buildings, will effect fuel savings from 20% to 50%.

Yet the belief that the first cost and operating costs of hot water are excessively high—a belief based on calculations so old that their ink has faded—persists with such tenacity that the majority of manufacturers and building owners let contracts for heating systems without even inquiring into hot water's cost. The result is wasteful steam systems.

If modern factories are to be operated on a rock-bottom economy basis then manufacturers and consulting engineers must get the exact figures on hot water heating—compare them with exact figures on other systems—before the contract for a heating system is awarded.

Consider it on this basis! The mean temperature for five Northern cities (shown on the chart at the right) from October 1st, 1922, to April 30th, 1923, was 40½°. Sixty-eight degrees is a comfortable, healthful temperature. It can be maintained with the thermometer outside reading 40½° by sending water into a properly engineered hot water heating system at a temperature of 145° to 155°. And on the colder days—days when the thermometer goes below the mean for the season—68° can be secured by increasing the temperature of the water only a few degrees, still keeping it well below the 212° needed to produce steam.

With any steam system you must spend good money for tons on tons of coal to produce an unnecessarily high temperature every day. For with steam you must have 212°—or you get no heat.

Hot water gives the right amount of heat—and *no more*. It gives this exact heat when the outside temperature calls for it—not before or after. It cuts coal bills anywhere from 20% to 50% or more. But in the last analysis these advantages are governed by the engineering skill with which the system is planned and installed. Improper engineering produces inefficiency in any type of heating system. The best results—and the most economical—are obtained only by experts.

For more than seventy years Grinnell Co., Inc., has specialized in industrial heating and piping. Grinnell Engineers are fully equipped to cooperate with you and your consulting engineer or architect to eliminate waste from your heating costs. If you want the truth about heating write us. Address Grinnell Co., Inc., 307 W. Exchange St., Providence, R. I.

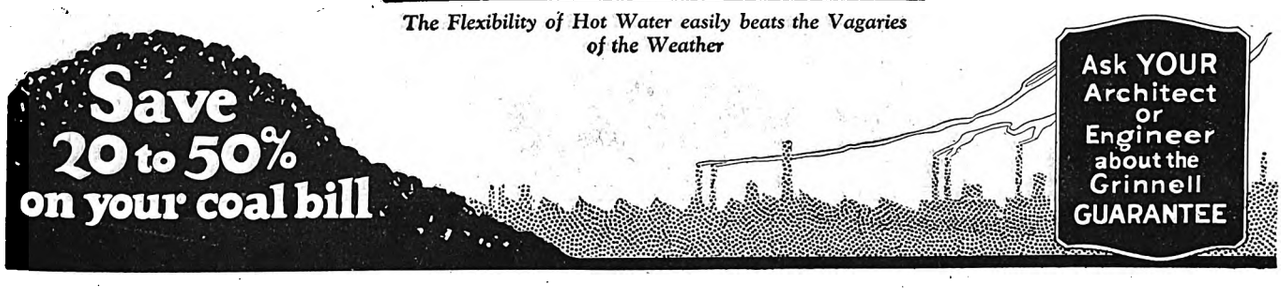
This chart is compiled from U. S. Weather Bureau reports

Weather for 1923 Heating Season

Averages in New York, Boston, Chicago, Pittsburgh and St. Louis

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Highest temperature, degrees F.	87	68	61	55	50	71	82
Lowest temperature, degrees F.	34	24	6	12	4	6	16
Mean temperature for month, degrees F.	58	46	34	32	28	37	50
Greatest daily range, degrees F	29	24	29	29	26	37	38
Least daily range, degrees F.	6	5	5	5	5	7	6

The Flexibility of Hot Water easily beats the Vagaries of the Weather



GRINNELL COMPANY

Automatic Sprinkler Systems | Steam & Hot Water Heating Equipment | Humidifying and Drying Equipment | Fittings, Hangers and Valves | Pipe Bending, Welding, etc. | Power and Process Piping

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JEFFREY

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Don't Waste Men
—on Material Handling Jobs

IN many a concern and many an industry, the loss of a nickel's worth of material is a great offense, while the waste of men is suffered without the batting of an eye.

This is neither logical, humane nor profitable. Wasting men by keeping them at unproductive work when machinery would do it faster, better and cheaper is indefensible.

The better way—the American way—is to concentrate men upon productive work at better pay, and let iron and steel in the form of Material Handling Equipment attend to the moving of materials.

The results that have been accomplished in some industries and by some individual concerns should be an inspiration and a challenge to others.

Handling material by mechanical means benefits both worker and employer; permits you to better place your own labor; the dollars invested in labor are made to yield a higher dividend, and workers are benefited by being engaged at more profitable tasks.

These advertisements are addressed to those executives who want their own concerns to secure the rich rewards that flow in any industry to the earliest users of improved methods.

THE JEFFREY MFG. COMPANY
Mining and Material Handling Equipment
COLUMBUS, OHIO

Material Handling
EQUIPMENT

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(*Continued from page* 62)

are pillar and jib cranes which are practically identical in method of operation although slightly different in construction. The pillar crane is a rotating type of crane as shown in Fig. 5 and is used under conditions as shown for loading and unloading materials and for general lifting purposes within a limited area. These cranes can also be installed indoors and used for many of the same purposes as a jib crane, but as it is necessary to erect a self-supporting pillar the jib crane is more frequently used, and fastened to the building wall or column.

Fig. 7 shows how the jib crane operates within the building for lifting heavy castings to drill presses, planers, milling machines, etc. The use of this device saves many thousands of dollars per year for American industries by eliminating idle production machine time, speeding up the operation, thus speeding up production, elimination of accidents to proficient and skilled workmen, and in many other ways. Jib cranes can also be installed in the yard as shown in Fig. 8 and they will quickly save their cost in loading and unloading materials from trucks used for intra-plant transportation and for inter-plant transportation.

Derricks are a form of crane and for this reason they are installed to perform many of the same operations as a crane, and when the service required is within their scope, they may be used to advantage as a component part of the materials handling equipment in construction work, railroad yards, shipyards, coal, lumber, or other storage yards, foundries, quarries and in many similar operations.

The steel derrick shown in Fig. 9 is used in the log storage yard of a lumber mill. The donkey engine brings the train of cars within reach of the derrick boom and they are unloaded and the logs piled. When required at the mill for sawing, the logs are reloaded by the derrick. It has been found that the derrick not only speeds up the two operations but also saves money by reduced handling costs. Fig. 10 shows wooden derricks working on the construction of foundations for the Bronx Terminal Market in New York City. In the large cities the common labor shortage for heavy jobs is felt even more than in some industrial centers and for this reason contractors are investigating all types of materials handling equipment. The use of derricks equipped with excavating buckets permitted this contractor to proceed with the work, and to quickly load the motor trucks, without the need of worrying each day about his common labor force.

Derricks mounted on a traveling gantry crane structure, as shown in Fig. 28, can be used on many operations other than the handling of ships' cargo, but they have also been found very efficient for this purpose. In order to serve ships on both sides of the dock, a derrick is mounted on alternate corners. These machines are electrically operated and are self-propelling, obtaining their power by means of a shoe and third rail.

Gantry cranes are to a degree an adaptation of the overhead traveling crane to outdoor service where there is no permanent elevated structure on which to install a crane. Different designs of gantry cranes are shown in Figs. 4, 17, 21, 31 and 32. The majority of installations of this type of crane are known as traveling gantrys, but frequently the traveling feature is not required and stationary gantrys are installed.

The hand-operated stationary gantry cranes as shown in Fig. 4 are especially adapted to railroad service, or

(*Continued on page* 69)



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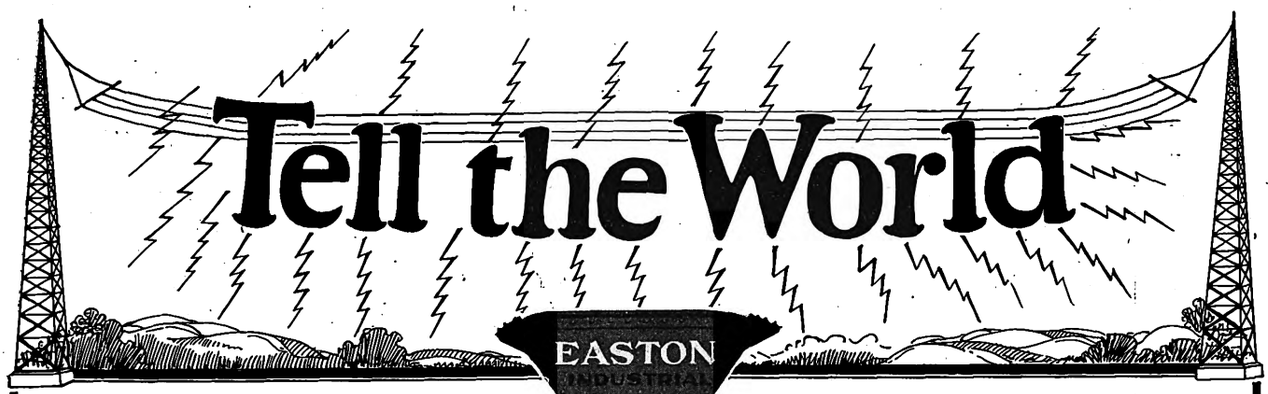


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(*Continued from page 66*)

in industrial works where the volume of heavy objects to be handled is not great and would not warrant the expense of electric equipment. The simplicity of operation and the low cost of maintenance make a crane of this type an economical machine for such service. An electrically operated stationary or traveling gantry crane similar to that shown in Fig. 17 should be installed when constant service is required or where the weight of the objects to be handled is beyond the capacity of a hand-operated machine. A crane of this type installed over one or more railroad tracks and equipped with a hoisting hook or with a sling is especially useful in loading or unloading heavy freight. It may also be equipped with a magnet, or for bucket operation and used to handle coal or similar materials when only a transverse movement is required. Under these conditions it is as applicable to the industrial plant as it is to the railroad yard.

Traveling gantry cranes vary from light structures mounted on small wheels and hand-operated to numerous designs of electrically-operated structures equipped with one or more crane trolleys and carried on trucks of substantial construction. These cranes are built with spans upward to 200 feet or more and are used in storage yards and at docks for handling ore, coal, coke, cement or manufactured materials; in railroad storage and transfer yards, for general purposes and for transferring heavy freight; and at wharves for handling cargo.

In traveling gantry cranes the bridge is fixed on trestles having legs which are generally mounted on trucks similar to those used on traveling overhead cranes. To meet special operating conditions, they are sometimes constructed as shown in Fig. 21, with one gantry leg—the other end being supported by other means, and also are frequently equipped with the movable cantilever at one end. The reason for equipping this particular crane with the movable cantilever was to permit it to unload cars on the second railroad track and yet be able to pass the gas holder so that it could travel the full length of the storage yard.

Fig. 31 illustrates the possibilities of traveling gantry crane construction. This crane has a movable cantilever at one end and a stationary cantilever at the other and is built with two types of gantry legs one of which is equipped with a special hopper and weighing device for loading materials to motor trucks.

Fig. 32 shows the type of bridge gantry cranes which are now being used by steel mills and related industries for handling their bulk materials. This is only a part of the equipment used by the Donner Steel Co., at Buffalo, N. Y., for handling their raw materials from ships to storage pile and from pile to plant. The cranes are equipped with large capacity buckets and handle many thousands of tons of materials per year. This type of equipment makes possible the handling of a volume of materials that would not be possible by old hand methods.

While cranes of standard or special construction have been described they have not dealt with special operations, or has it yet been pointed out where one or two cranes can eliminate the use of many derricks, cranes and hoists. In the illustration, Fig. 29, however, we see the Isthmian Steamship Lines, ship "Steelvendor," which is equipped with two special revolving, electrically-driven cargo unloading cranes which are a part of the ship's

(*Continued on page 71*)

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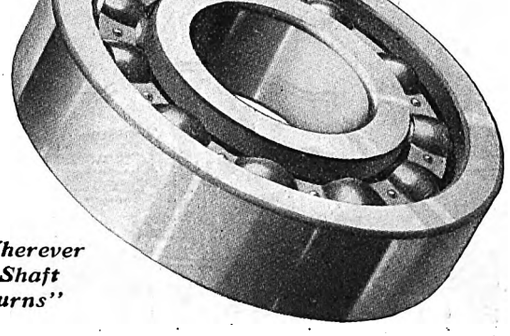
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(*Continued from page 69*)

equipment. These cranes, because of their long booms and revolving feature, can operate much quicker on the loading and unloading operation than the ordinary ship derricks and slings. In addition they centralize the unloading control to two distinct points and do away with a large number of derricks, tackle and hoisting engines.

The revolving cantilever crane mounted on a tower as shown in Fig. 30 has a number of advantages, the main one of which is its ability to be stationary and yet serve a very large area. The stationary feature makes for lower maintenance cost, replacing worn out moving parts. This crane is equipped with two large capacity buckets and is handling clinker at the plant of the Riverside Portland Cement Co., Riverside, Cal.

It is not customary to call a hoist a crane and yet they are frequently used in place of cranes. For this reason we show as a comparison to Fig. 26 the hoist handling a 300-ton locomotive in Fig. 25. Shop construction might be such that it would be impossible to install a crane and then in order to raise the load a hoist would serve the purpose. It is true the hoist cannot travel in a longitudinal or traverse direction, but it can lift the load.

Many plant executives are so used to seeing cranes that they do not realize their true value or are they investigating their present installations to see if they are being overloaded. Many cranes are now showing a high maintenance cost because they are performing too much work. Many crane bays which are now equipped with one crane should be equipped with two or more cranes in order to properly handle the work. In other instances the crane was installed to handle maximum loads of 5 tons, but as production increased it was found necessary to overload the crane in order to handle the required materials within the working day. This practice of overloading cranes is dangerous and should not be practiced.

It will pay plant executives to look over their present crane equipment and see if it is properly used or abused. Cranes, as in the case with other materials handling equipment, are considered as everlasting and not requiring proper upkeep. This lack of the proper knowledge of cranes, their uses, and the need of constant supervision is the cause of most breakdowns and delays. If the executive will look at each delay and each breakdown in the light of lost dollars and cents, lost production time, inconvenience and demoralization of plant working schedule, he will quickly see the need of properly caring for the crane equipment.

The many types of cranes here mentioned have many points of application in practically every industry and the savings that can be effected on any one operation depends largely on selecting the right type for the job and then properly maintaining it.

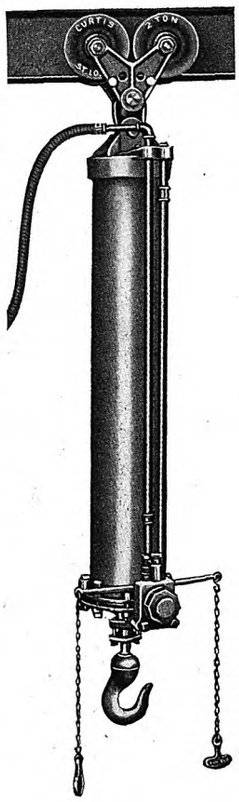
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Pioneers of Power

(*Continued from page* 18)

inate the condensation of live steam in the engine cylinder with the resultant loss of possible work. He recognized that the alternate heating and cooling of each cylinder end by the live and exhaust steam was the cause of this condensation. In his uniflow engine he prevented this loss by making the steam flow in one direction only. Steam enters at each end alternately and exhausts at the midpoint of the cylinder barrel.

Although Prof. Stumpf's experiments were conducted abroad, the success and practical value of his invention were at once appreciated throughout the engineering world and we have today in this country an increasing number of engines of the uniflow type.

But the development and perfection of the reciprocating steam engine has been but one phase of the progress in the steam engineering world. Equally important strides, with even more far-reaching results, have been made in rotary prime movers, or steam turbines, as we familiarly know them.

Roughly speaking the entire development of the steam turbine has taken place within the past fifty years, in spite of the fact that Hero described his reaction turbine more than twenty centuries ago.

In the steam turbine, rotation is produced and power developed by directing steam at high velocity into single or successive rows of blades, which are mounted on the circumference of a revolving drum. The kinetic energy of the mass of steam is imparted to the turbine rotor in this way.

When the motion is produced by the "kick" or reaction of the steam jet as it leaves the blades, the turbine is a reaction turbine. When the impact of the jet upon the blades produces rotation the turbine is an impulse unit. These are the two fundamental types of turbines.

In the development of the reaction turbine Sir Charles A. Parsons was the leading exponent and creative genius. He found many difficulties to be overcome and expended a considerable personal fortune in pursuing this work.

Backed by the unfaltering courage of his convictions, he began in 1884, facing his first problem, namely, that of determining whether mechanically constructed bodies could be operated at such high speeds as 18,000 to 20,000 revolutions per minute without flying apart.

Having mastered his initial problem, he proceeded to the building of a small turbine. In his early work he was associated with a firm of engineers whose principal business was the building of small units for operating lighting sets on shipboard.

He realized, however, that the sphere of the steam turbine was in the larger sizes. Accordingly he later established his own engineering works for the purpose of building steam turbines and applying them to what he believed was their proper use, *viz.*, central station work.

In this work his progress was materially retarded because of the fact that there was small demand for high speed machinery, and high speed electric generators were then built only in the smaller sizes. Gradually, however, as the economical possibilities of large high speed units became apparent the opportunity for the steam turbine grew and his field widened.

Sir Charles Parsons was unrelaxing in his energy in the development of the reaction turbine, his efforts cul-

(*Continued on page* 76)



Smoke —

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THE cloud of dense smoke that streamed across the top of almost every old-time letterhead was once the pride of thousands of manufacturers—the great symbol of industrial activity.

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Many enterprising manufacturers have eliminated the smoke decoration from their letterheads. There are still hundreds, however, that have not eliminated it from their furnaces and stacks who could do so by installing mechanical stokers. The owners, executives and directors of these plants will find a highly informative and timely message in the booklet, "Coal—The Basic Fuel." Have you read it? A copy will be sent you free on request to The Secretary of the Association.

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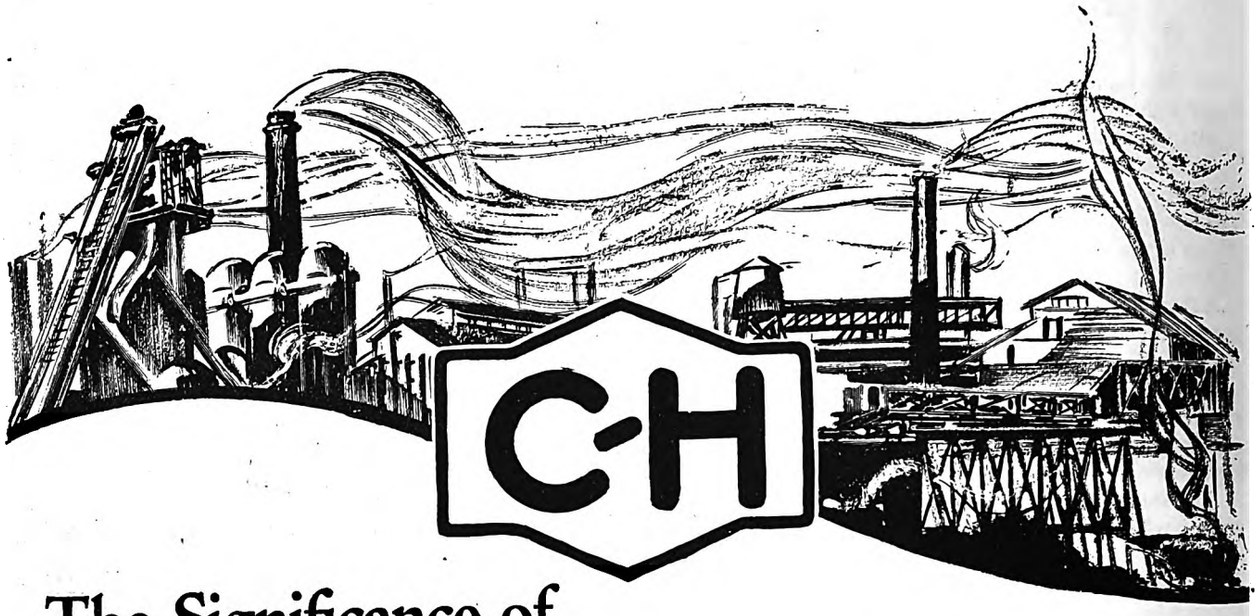
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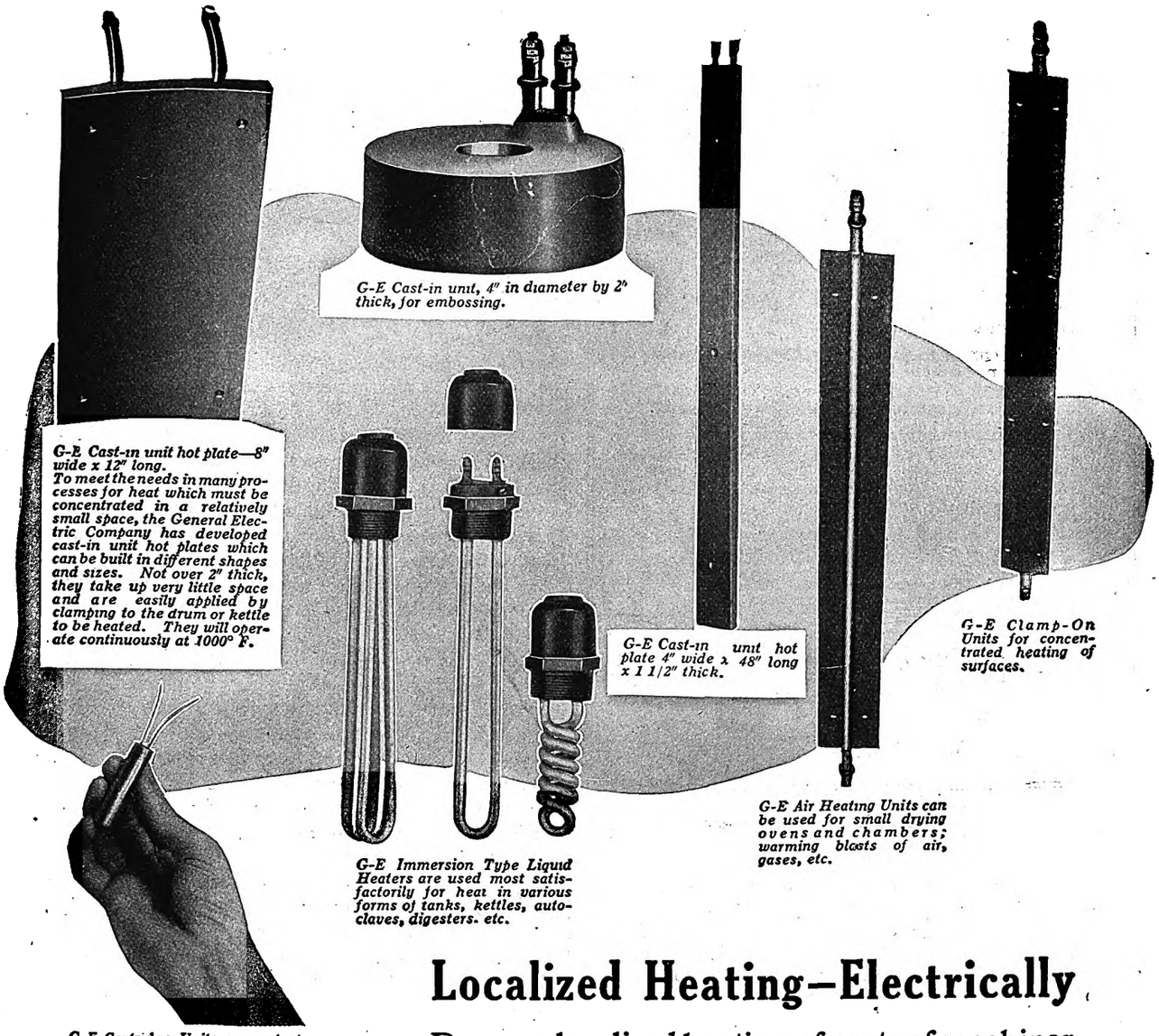
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(*Continued from page 73*)

minating finally in the construction of enormous turbines for direct connection to the propellors of express steamers in marine service.

The impulse turbine made its debut in the seventeenth century in the form of a mechanical toy known as the Branca turbine. This consisted merely of a jet of steam striking the blades of a paddle wheel, which was mounted so that it could revolve. The idea existed merely as an idea and no practical use was made of it until recent years.

The impulse turbine and its possibilities attracted the attention of Charles Gordon Curtis while he was pursuing his studies at Columbia University. His energies were directed to the development of this type of prime mover in this country, while Sir Charles Parsons was perfecting the reaction turbine across the water.

With the development of an efficient prime mover, the perfection in design and increase in capacity of steam boilers has gone hand in hand. Within recent years there has been a reaching out for higher pressures and greater superheats, until it is difficult to say just what our next practical step will be. Perhaps, when certain difficulties that now seem unsurmountable have been overcome, we shall enter upon this now more or less unexplored region. The day of the "super-pressure" plant appears to be ahead of us.

With this striving for higher capacities we have also seen the attainment of higher economies. William LeRoy Emmet, consulting engineer of one of our largest industrial concerns in this country, is the inventor of the mercury boiler, a radical departure from previous boiler practise. Results obtained from his experimental installation at the Hartford Electric Light Company indicate a possible fuel saving of almost 50 per cent.

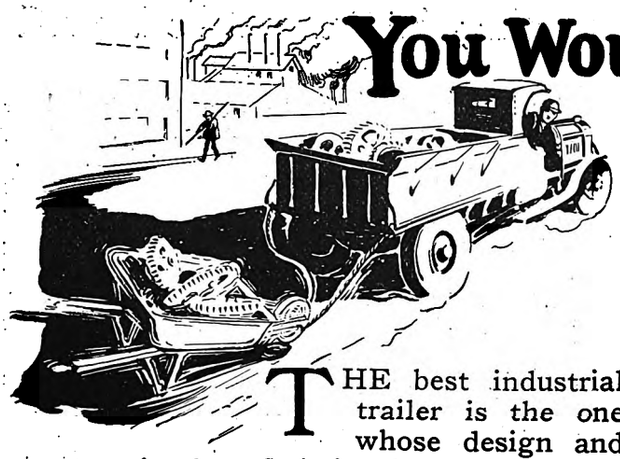
The same genius which Mr. Emmet has previously displayed in the improvement of the Curtis turbine and in other phases of power development has marked his efforts in this latest achievement.

Mr. Emmet has had many difficulties to overcome. During his early experiments it was found that no form of packing or calking of joints would resist the mercury vapor. It was necessary, therefore, to weld every joint in the apparatus. It was also necessary to devise methods of operation, as there was naturally no precedent to follow. The properties and characteristics of mercury vapor had to be studied with a view to developing accurate data.

It is early at the present time to say that all the operating difficulties have been overcome. Mr. Emmet has been working on this latest achievement for the past eleven years. If continued experiments confirm the apparent commercial value, we shall eventually enter upon another new era in the generation of steam and the development of steam power.

Some of the subjects to be discussed at the Spring Meeting of The American Society of Mechanical Engineers, to be held in Cleveland May 26-29, 1924, are—Power Problems in the Steel Industry, Interchangeable Manufacture, Windmill and Fan Design, and Materials Handling in Industry. Joint sessions will be held with both the American Society for Testing Materials and the American Society of Refrigerating Engineers.

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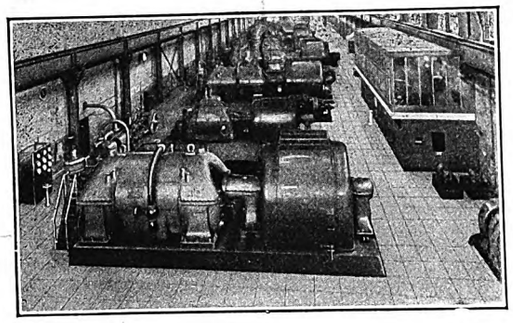
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Putting the Sun on the Payroll

(*Continued from page* 23)

After the general structural design is established the next matter to have attention is the windows, including their arrangement, construction and the type of glass.

Windows should extend from the working plane to the ceiling or as near to the ceiling as possible, not only for maximum illuminating effectiveness but also for ventilation. There is no value in carrying the glass below bench-height. The wall space is generally needed for radiators, benches, conveyors or other equipment. Since much heat is lost through glass it is also economy to use a solid wall to the floor. Machinery should be placed correctly with respect to the windows, lest the operatives be forced to work in their own shadows.

The choice of window sash and frame depends on a number of conditions. If maximum light is to be obtained through a given aperture in the wall, it is well to use sash with narrow frames, mullions and meeting rails. Otherwise the choice is governed by considerations of cost, durability, ventilation, appearance and method of cleaning.

Of the various types of sash on the market, "factory" or rolled steel sash is probably the commonest. It can be used for large openings and can be set in long continuous rows. The members are small and offer little obstruction to light. Openings for ventilation can be provided, which by the way, should be placed at the extreme top and bottom sections if thorough ventilation is desired. Center openings only are of comparatively little value. Continuous sash comes in standard sizes and units, with pivoted or projecting sections for ventilating.

There are various types of sliding sash, the most common being double hung windows similar to ordinary house windows, in which the upper and lower sash move independently of each other, being counterbalanced with weights. In another type the upper and lower sash are balanced one by the other, so that when one goes up the other goes down and vice versa. Both types of sliding sash require rather heavy mullions and meeting rails.

Where thorough ventilation is essential some one of several types having a combined sliding and pivoting or projecting action may be used. They are generally operated by a simple system of levers so that openings occur at the top, center, and bottom of the window simultaneously, and the glass projects at an angle to the frame in such manner as to prevent rain from driving into the room.

Rolled steel sections are used for low cost work and general factory purposes, while bent steel shapes or bronze are employed for higher grade work such as for office buildings.

Next in importance, and in some ways the most important item of all is the kind of glass used. A clear or transparent glass transmits light most efficiently, yet often a translucent but not transparent glass is to be preferred. Of the transparent glasses, there is choice between ordinary window glass of single or double thickness and polished plate wire glass. Clear glass should be used in windows up to and a foot or so above eye level even if a diffusing glass is desired in the rest of the windows. Manufacturers find that their operatives are more contented when they can look out doors on occasion, due partly to the fact that it is resting to the eyes to get a

(*Continued on page* 81)

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A manufacturer—serving only one state—saves $9,048.00 a year by using Pioneer Boxes

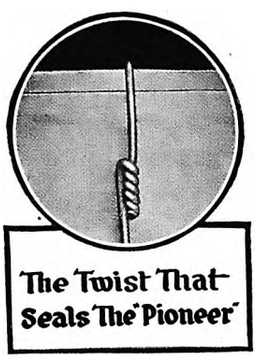
OVER a year ago a meat packer—serving only one state—became interested in Pioneer Wire-bound Boxes. A trial order was placed for one car-load. For the past year all their products have been shipped in Pioneers—ranging up to 300 pounds capacity.

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(*Continued from page 78*)

distant view from time to time. Furthermore certain types of rippled or prism glass produce an intense glare which is most discomforting if placed at eye-level.

Wire glass, often required for fire protection or where there would be danger from shattered glass, comes only in the "polished plate" grade which is transparent, and in the ordinary "rough" grade which is translucent. The latter is much less expensive than the former and has the advantage of diffusing and distributing the light in an effective manner.

Daylight entering a transparent window largely falls at an angle, penetrating but a relatively short distance into the room. Much of the light is absorbed by the floor and machinery. To carry as much as possible of the light toward the center it is desirable to bend these oblique rays more or less horizontally, or else to have them strike the ceiling or other good reflecting surface which will spread them into the interior. Rough glass breaks up the rays of light, diffusing them in all directions so that some are deflected from the ceiling, others are cast horizontally into the room and the rest fall on the working plane near the windows. Enough of the light is spread in the right directions to make the use of a rough glass preferable to clear glass, especially in wide buildings.

More efficient results are obtained by the use of glass having prisms so arranged as to accurately bend the rays to a horizontal position. Such glass is highly effective but is too costly for general use. A less expensive substitute, and one practically as good is ribbed glass, which has semi-circular ribs of small radius rolled into one face. Theoretically these ribs should be placed horizontally, but in actual practise, to prevent their catching dust and dirt, the ribs are often set vertically.

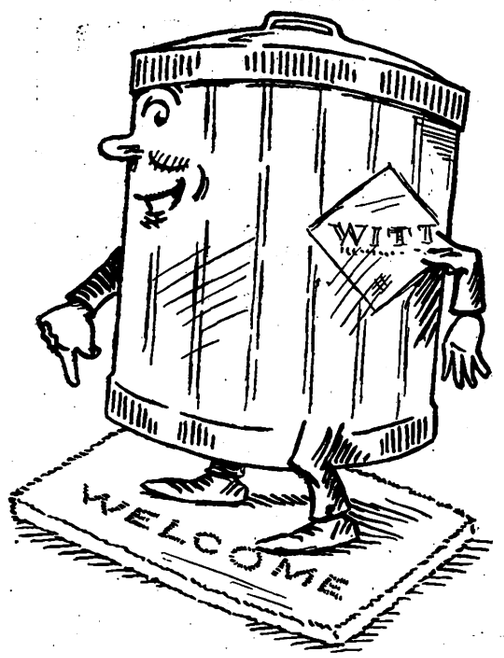
Other types of translucent glass such as "ground," "frosted," "flowered," and "milky" are useful only for decorative or other special purposes as they do not transmit light as efficiently as ribbed and rough glass.

Corrugated wire glass is particularly useful in sawtooth skylights, for in the opinion of many engineers its great diffusing powers make it more effective than flat glass. It is also useful for skylights, monitors, marquises, and for roof lights in conjunction with corrugated metal and asbestos roofs.

Research has been carried on for years to find a glass that will admit light but not heat, for use in windows receiving the direct rays of the sun. Recently a "non-actinic" glass having a slight yellowish color has been placed on the market which, it is claimed, will not pass the ultra-violet and infra-red rays and thus keeps out the heat as well as the light elements that are harmful to some dyes, rubber, textile goods and other sensitive materials. There are also one or two kinds of transparent color stains to be applied to clear glass which are said to achieve this same purpose.

Special kinds of glass are prepared to meet unusual conditions. Roof tiles of glass can be had to closely match clay tiles to form an almost invisible skylight. Cement roof tiles are made with glass lights embedded in the centers which likewise may be used for a limited amount of light in the roof. The heavy prisms familiar as sidewalk lights for the illumination of basements and subways may also be set in concrete roofs. Some successful installations of this type have been made in railroad stations and train sheds.

(*Continued on page 83*)



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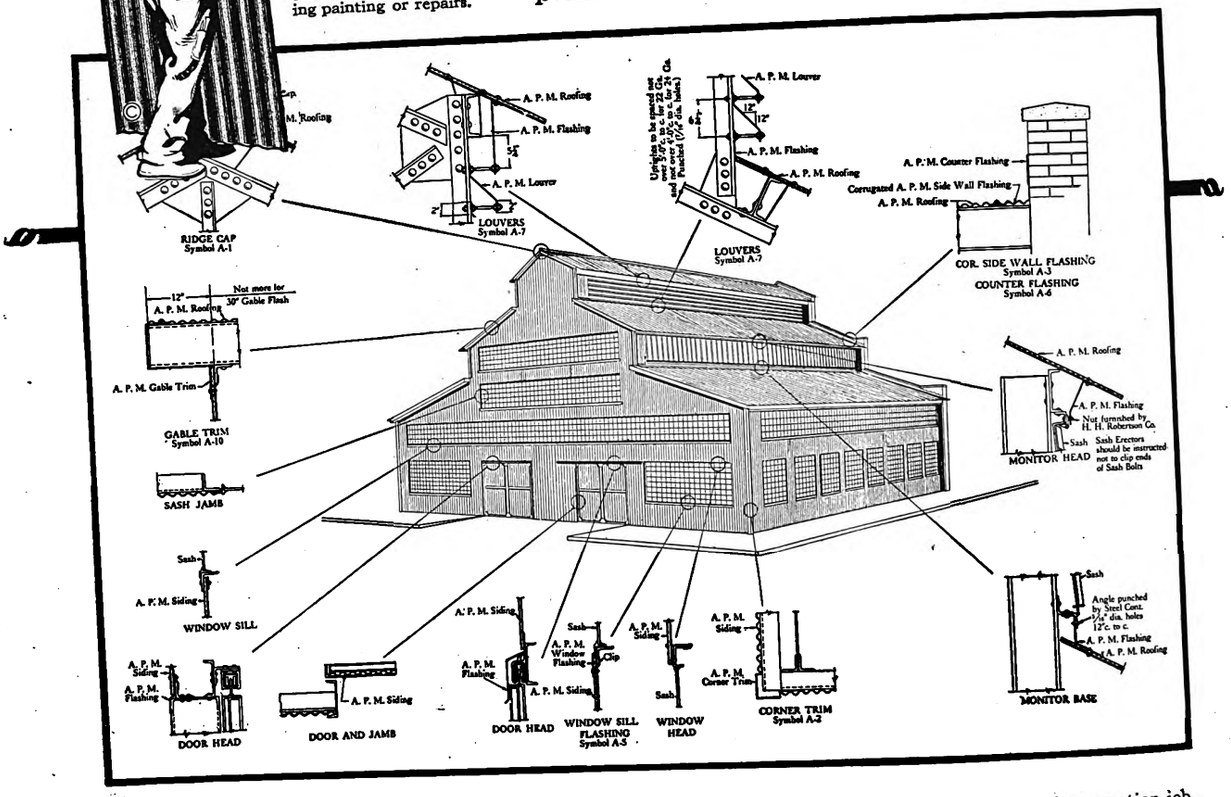
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(*Continued from page* 81)

In winter the windows in many plants condense a great deal of moisture which not only may drip onto machines and goods below but which also reduces the translucency of the glass to some extent. Where high humidity occurs within the plant it may be necessary to use double glazed windows in which two panes of glass separated by a dead air space are set in each section of the sash. This effectively reduces the conductivity of the window and thereby eliminates condensation.

The most efficiently designed factory with great areas of windows to provide the maximum of light may yet fail to achieve its purpose if the glass is not kept clean. It costs money to get good natural light into a building, for large windows mean increased heat losses, yet often the advantages gained by the large windows are lost for the lack of occasional cleaning. If good lighting pays in higher productivity then the cost of window washing is money well spent.

Glass accumulates dirt with surprising rapidity and its translucency falls rapidly as the film becomes more dense. It is not uncommon to see foundries and machine shops with huge monitors and many square feet of glass so dark within from the grime on the windows that artificial light is needed by the workers even in day time. Washing should be done periodically and systematically. Pivoted sash may be cleaned from within the building. Sliding sash and other types which allow a man to climb outside can be cleaned by workmen standing on the sill. Provision for safety belts should always be made when such windows are installed. Large areas of fixed sash generally are cleaned two or three times a year by workmen on painters' scaffolds suspended from the roof. Windows in one story buildings may be cleaned with a hose from the ground.

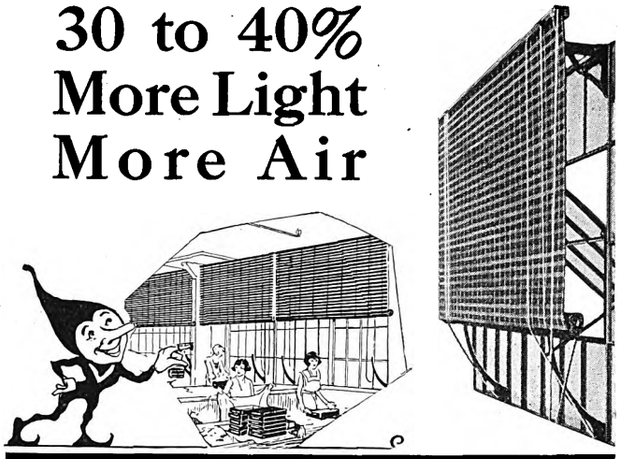
The intense glare of direct sunlight often must be subdued for the sake of the workmen stationed near the sunny windows.

For a very cheap makeshift, whitewash is sometimes applied directly to the glass in summer, but it has the obvious disadvantages of being still there on cloudy days and in late afternoons. White cloth curtains of cotton duck or similar material that slide across the windows are frequently used but they are likely to blow about in the wind and constitute a serious fire and accident hazard. Roll shades of various types are available and they may be applied individually to the movable ventilating sections. When kept under tension they are reasonably satisfactory. Various modifications of venetian blinds are also used and some of them function successfully.

Now turning from windows and window appliances the last matter of importance is the interior finish of the building, with particular reference to the color and surface treatment of the walls, columns and ceilings. The high intensity of illumination at the windows must be carried as far into the building as possible by reflection from objects near the windows. A great difference in the interior lighting may be observed by using various colors on the walls and ceilings. White is by far the most efficient color for this purpose.

A habit of long standing that will doubtless eventually give way is the custom of painting all ironwork and machinery a dead black. In time it is reasonable to believe that much of our machinery will be finished in light grey or sand color with a corresponding improvement in the brightness and cheerfulness of our factories.

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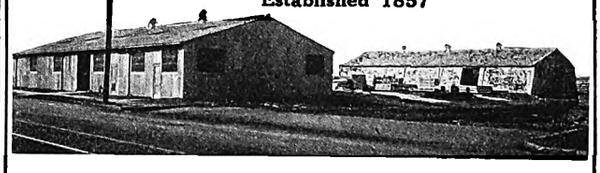
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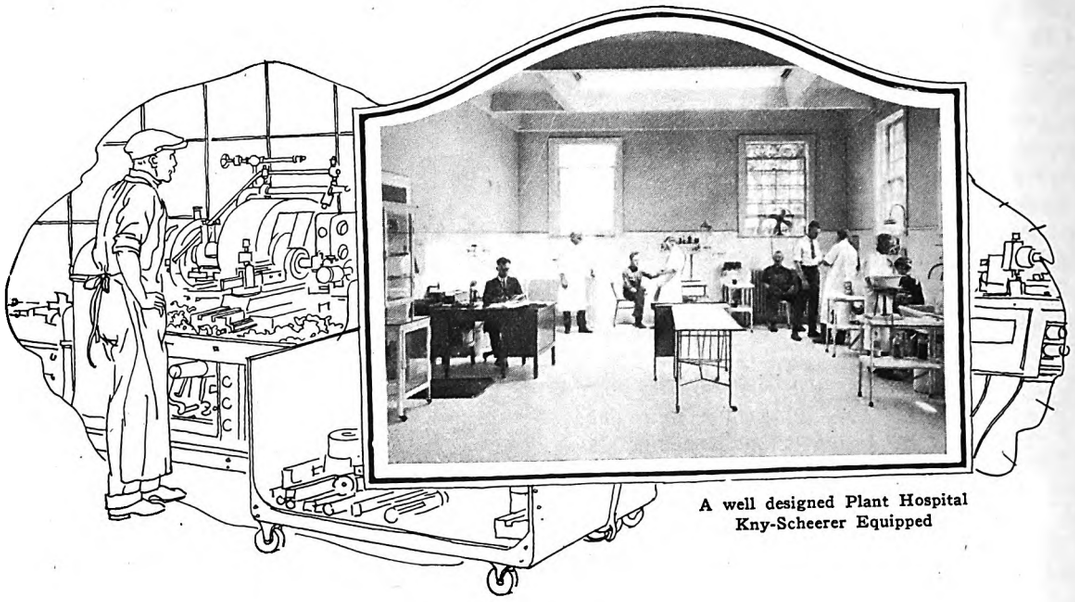
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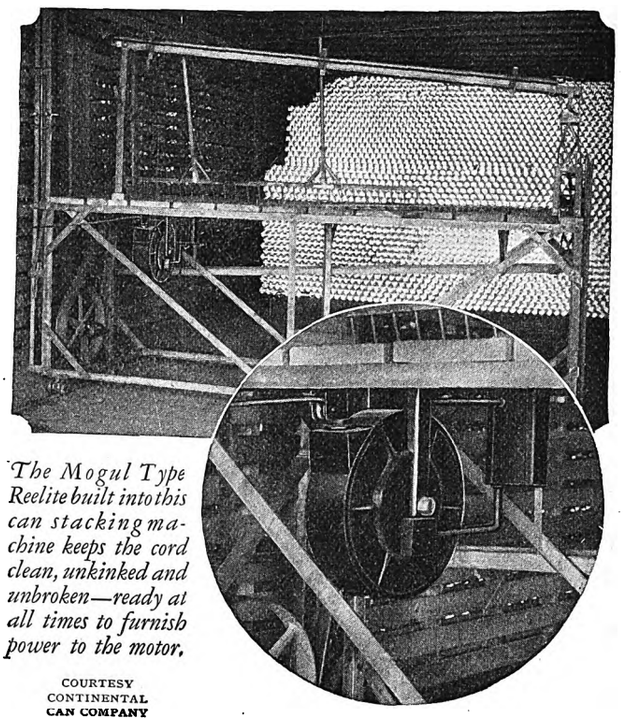
(*Continued from page 26*)

it cuts down the rating for the same operating temperature. Totally enclosed direct current motors may be used in these cases but squirrel cage induction motors are much better because they have no sliding contacts. With alternating current, squirrel cage induction motors are generally used for plant service. These motors are excellent for average plant line-shaft installations, but they should be kept at nearly full load in order to keep the power factor high. The tendency in most plants after the war was to leave motors in place as they were, and run only a portion of the machines, thus making a very low power factor and increasing power bills. If any such overmotored installations are still in place a thorough survey should be made of the entire plant with a view to rearranging motors so that they will be working at about normal loading. There are on the market motors that operate at unity power factor, and it is evident that on many installations they are extremely valuable. They naturally cost quite a little more than an induction motor but after a few years they are a paying investment.

If it is possible to have a number of motors alike, it is well to have a spare or two always ready to put in, in case of emergency. If complete spare motors cannot be held available some spare parts should be kept for all important motors. Plain bearing motors require more maintenance than ball bearing motors, as plain bearing should be oiled at least once a week. With ball bearings they can be packed with grease every three months in most cases.

A great many plants are gradually changing over to individual motor drives on each machine. This can be done in one department at a time, beginning with erecting shops and departments with a small number of heavy machines. This change is often advisable also when additional machines are to be installed in departments where the line shaft is already overloaded. The power saved by eliminating the friction of shafting, countershafts and belts is a big item and although individual drives are more expensive in first installation cost, they will pay for themselves in a few years by savings in friction and lower maintenance costs. Individual drives are especially good on machines that are operated at their full capacity but only at irregular intervals.

All plain bearing motors should be oiled regularly at least once a week, and every month or two the old oil should be drained out and the bearing washed out with kerosene. The rings in a ring oiled bearing should be perfectly free to rotate. At least once a week and usually at the same time as the bearings are oiled, the dust should be blown from the windings with an electric blower designed for that purpose, or with compressed air. In small plants a pair of bellows may be used. These are not so efficient as the motor driven blowers, but they should be used if the other methods are not available. All motors and electric equipment should be regularly inspected and reports made to the Plant Engineer's Office. One of the main points to inspect on induction motors is the clearance between the rotor and the stator at the bottom. The motor manufacturers can furnish these gap gages for each size of motor. When the bearings wear they allow the rotor to drop down, thus making the gap



The Mogul Type Reelite built into this can stacking machine keeps the cord clean, unkinked and unbroken—ready at all times to furnish power to the motor.

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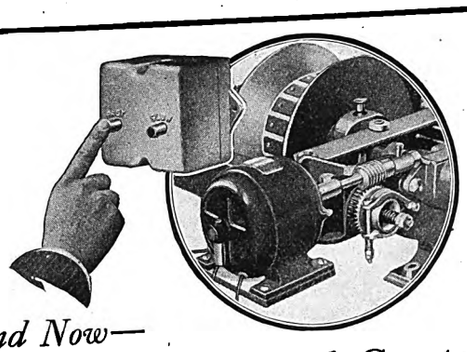
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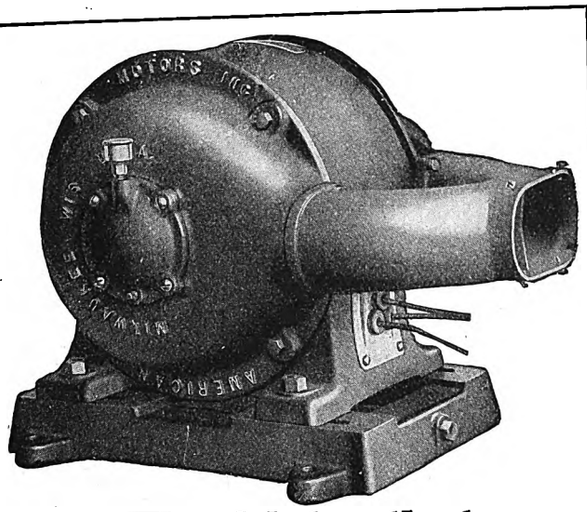
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at the bottom smaller; and as the bearings wear more and more the rotor drops until it touches the stator, causing a burnout. Inspectors' reports should be carefully studied and work orders made out for any jobs necessary to be done immediately and a tickler made to bring up jobs which may become urgent in a few months.

Elevator and crane motors are subjected to very severe service and it is quite important that they be inspected and kept in good condition. These services are exceptionally hard on starting panels, as the contacts are subjected to arcing in many cases. For all parts that are apt to burn out or wear out frequently, there should be a spare part in the maintenance department's stockroom. This is absolutely essential if repairs are to be made quickly, and a small expenditure for spare parts is really an investment in breakdown insurance. Where elevator machines are located over the elevator, an iron grating should be provided so that the men can walk all around the equipment without danger of falling. On large cranes a footwalk is usually provided so that it is possible to get at all vital parts. Magnetic brakes should be carefully maintained and lifting magnets should be in good order to avoid accidents. The feeder wires should be just tight enough to be raised off their supports when the crane moves past them and then allow them to drop back into place. If too loose they may get off their supports.

In the regular maintenance work in the plating department, it is often necessary to renew or reinforce the low voltage distribution buss bars from the plating generator to the tanks. The accepted method is to use heavy copper buss bars supported from the ceiling or walls. The runs should be as short as possible and in this connection it is often possible to rearrange old installations when additions are necessary. The direct connected motor-generator sets are preferable to the belt driven generators if new or additional equipment is necessary. It is best to have indicating meters and rheostats on each tank so that the rate of deposit may be regulated correctly. Many cases of poor plating could be improved if the plater had instruments to tell him what he was doing.

One of the frequent jobs in maintenance work is reinforcing existing power lines to take care of additional or heavier machinery. This can easily be done with open wiring but with conduit wiring it presents a problem. If new conduit is installed it is best to have it large enough to take extra wire in case of expansion. The labor of installing is about the same and the cost of using a size larger conduit is usually not excessive. Many parts of old plants still have exposed power wiring, and this should gradually be put into conduit especially if changes have to be made. Good materials in wire are especially important for low maintenance costs. This is especially true of insulation on wires in order to obtain the longest life possible in proportion to the cost. When sharp corners are necessary in conduit, fittings must be used, but where large swing bends are possible they should be used, as this method cuts down the cost by reducing the number of fittings necessary, and also allows longer stretches for pulling in the wire. When pull boxes are necessary they should be large enough to pull the wire through easily and have room for the spliced wires. Conduit work should be carefully inspected to see that the burrs are taken off the ends of the pipes so that

(*Continued on page* 88)

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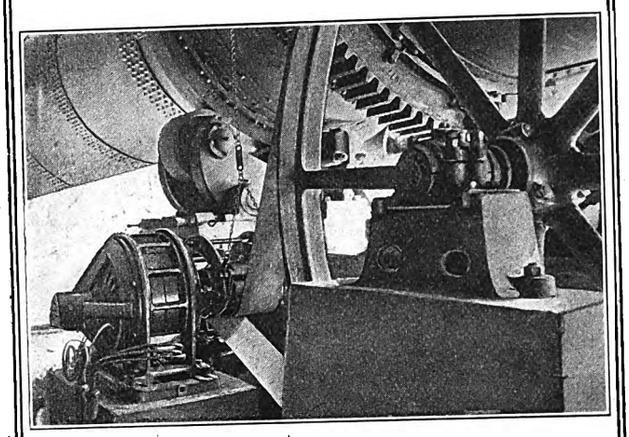
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(*Continued from page* 86)

the insulation will not be torn when the wire is pulled in. The locknuts and bushings should also be inspected to see that the threads are not so small that they barely hold.

All the motors in the plant should be periodically tested and a record kept which can be studied over a long period. This will be extremely valuable in finding troubles and correcting them before they get serious. The testing instruments may be indicating or recording; the latter being much better, as they record fluctuations that would not be caught by an engineer reading the log of an indicating meter. For this kind of test work the portable instruments are best. For complete tests, Ammeters, Voltmeters, Wattmeters, and power factor meters are used, but some may be omitted at the start. A glass test thermometer should also be inserted in the windings of the stator to check up the temperature rise under full load.

Where both A. C. and D. C. current are used, a wattmeter which will take care of both should be used. This is really the most important instrument and should be equipped to operate on all the voltages in use in the plant. In order to do this, current transformers are used when it is connected to alternating current circuits, and shunts are used on direct current circuits. Recording wattmeters do more than show what the motor is doing. Taken over a period of months they show whether the machines and shafting driven by that motor are getting in bad condition and using more power than they should.

It is a good idea to check the speeds of motors and line shafts under full load occasionally. This is easily done with a hand tachometer and will often show that, due to one reason or another, the lineshaft is not running up to speed. This cuts down production and should be remedied at once. Pulley sizes are usually figured from rated speeds without taking any slowing up factors, like belt slippage, into account.

Voltage regulation is a factor which affects very materially the speed and capacity of motors, and therefore induction voltage regulators are sometimes necessary to keep the voltage constant. When lighting and power are combined an unbalanced load is likely to result and voltage adjustments must take care of this in addition to load variations.

A great many plants are overmotored; which means, if they are using alternating current, that they have the problem of low power factor to contend with. With a low power factor the conductors have to carry a larger current than would be necessary with a unity power factor. This larger current heats up the conductors and reduces the carrying capacity of the line. Power factor can be improved in several ways. The first way is to rearrange motors so that each one carries nearly its full load, this automatically betters the power factor and at the same time increases efficiency. Another way is to use synchronous motors as condensers. The writer has used these motors on large air compressors, and on steady loads where the correction to be made is not great, they are often used. Another more recent way is to use static condensers. These do not require any attendance, which is often a point to be considered. If power is purchased the power factor often affects the bill, and if this is so it makes an additional reason for bettering it. It is often possible to find motors which

(*Continued on page* 90)

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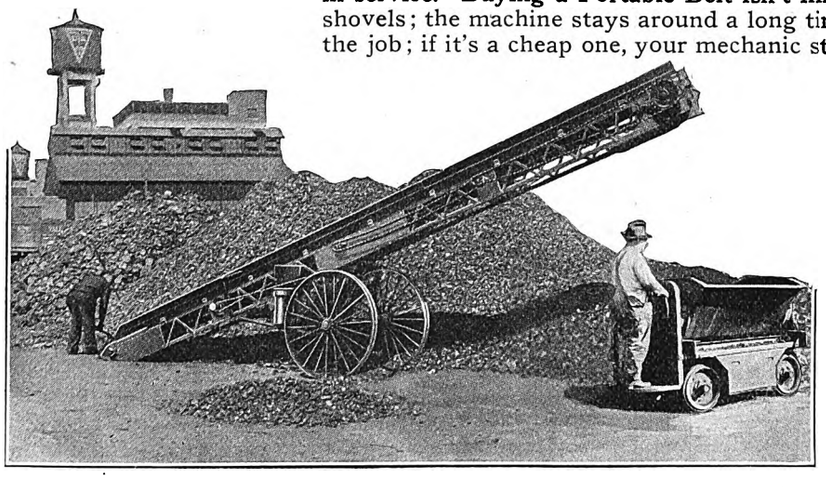
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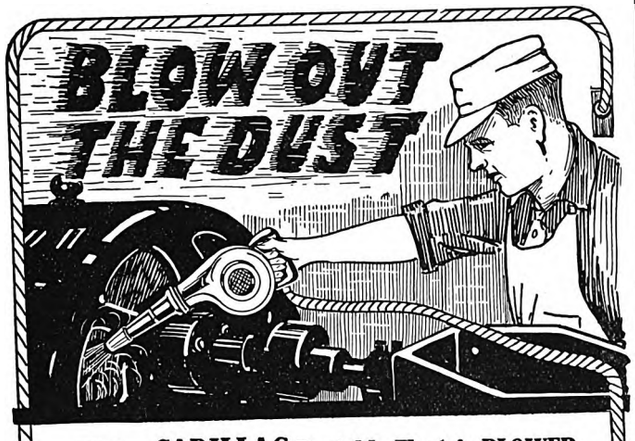
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(*Continued from page* 88)

are having a marked effect on the power factor, by means of power factor recorders, and when found and these places remedied, the whole system is much better.

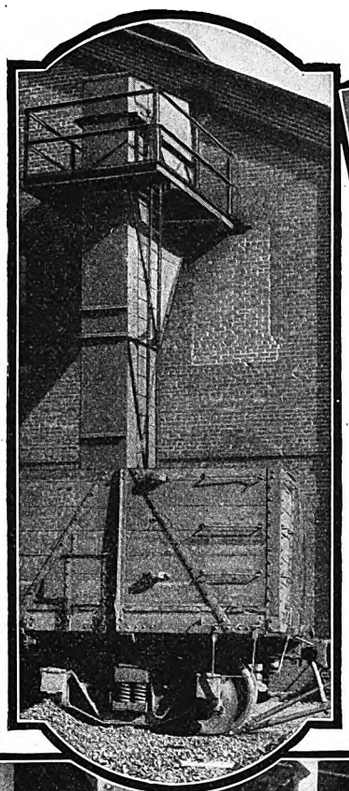
All motors should be properly equipped with controllers or starters to eliminate the danger of throwing a motor across the line. Indeed most codes prescribe that all but the smallest motors be protected. Direct current motors used in the average plant are usually compound wound motors. All D. C. motors should have starting rheostats or controllers so that the motor may be started slowly and not injured by excessive current. It is important that about thirty seconds be taken in starting, and one man in each department should be trained to start the motors correctly. A great deal of maintenance work can be avoided in this way. In stopping a D. C. motor the switch should be opened, allowing the arm on the rheostat to return to the starting position. For reversing duty the drum type controllers familiar to all those who ride in trolley cars are used. When automatic or remote control is desired, the automatic or self starter is used. These starters may be controlled in a variety of ways, probably the most frequent being by push button. If the distance to the point of control is very great there is a large saving in copper, which is of course partially offset by the higher cost of the automatic starter. Low-voltage protection should be afforded as well as no-voltage protection.

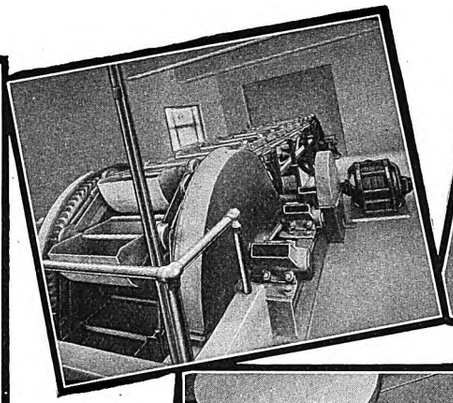
Auto transformer starters are quite commonly used on alternating current motors. They should be so arranged that the handle must be moved to the starting position first and, when the motor is up to speed, quickly moved to the running position. It should not be possible to operate in any but the correct manner. To stop the motor it is usual to trip the low voltage release. Time limit overload protection is often used instead of fused protection especially in cases where momentary overloads are apt to be present. For speed regulation with A. C. current, slip ring motors are used with a speed regulator, in addition to the switch or circuit breaker. Drum type controllers are generally used on reversing service. Automatic or self-starters may be used with squirrel cage motors when the starting torque required is not too great, and they are also used with slip ring motors on heavy duty service such as compressors, etc. All starters should have low voltage protection which provides that the motor will not start again when the power goes on after a shutdown due to voltage failure until the operator either starts the motor again in the case of manual control, or sets the master switch on an automatically controlled motor. A fused switch or a circuit breaker is necessary ahead of the starter, and it is now possible to use completely enclosed fused safety switches or enclosed circuit breakers. The latter will eliminate the need of switch and fuses and, with some designs, the overload relay from the compensator. For small A. C. motors the enclosed circuit breaker affords protection without the necessity of using a compensator.

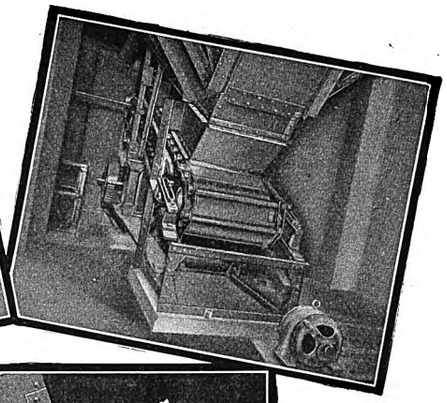
The question of when to use circuit breakers instead of fuses must be decided in each individual case. However, as a general rule it should be said that any circuit which is electrically all right and yet keeps blowing fuses, should have the fuses replaced by a circuit breaker if for no other reason than to save time. Indeed, the time wasted in getting new fuses and putting them in

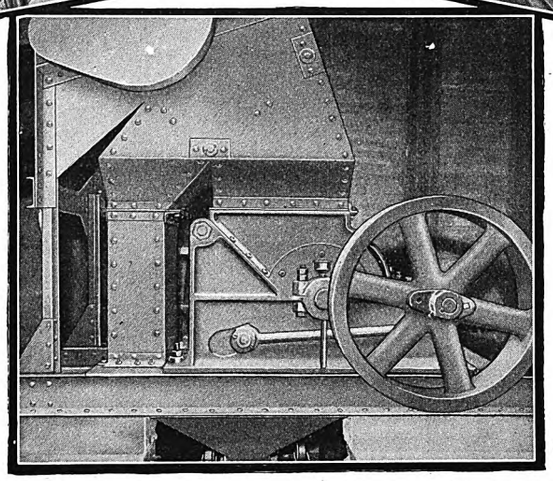
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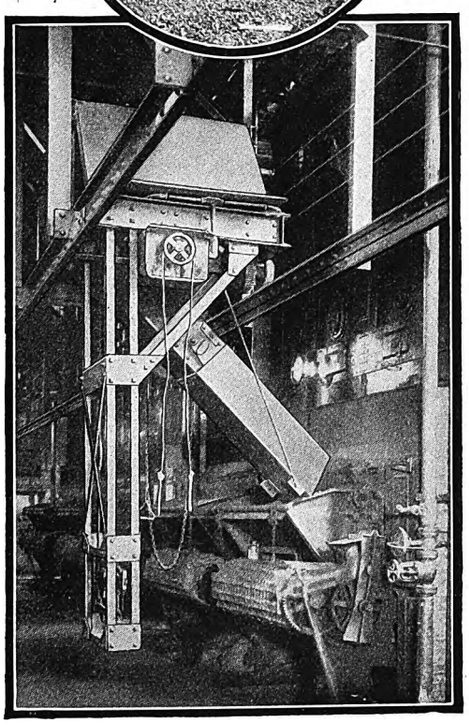
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(Continued from page 90)

often amounts to a good many dollars if all the expense is figured up. Of late years many renewable fuses have appeared on the market and in plants where the electricians have spare time, and therefore can reload fuses without additional expense, they are undoubtedly cheaper than one-time fuses. In a large plant a set of severe tests should be made of all available types before standardizing on any particular brand. They should be investigated from the standpoint of possibility of refilling with more than the rated amount of renewable fuse links, as this is sometimes done and is discovered after something happens.

Electrically heated furnaces have several distinct advantages over other types. For heat treating steel, scale is eliminated because the atmosphere in the furnace is neutral, it is easy to control the temperature, and a higher average quality should result. For annealing and other uses they are very evenly heated and are therefore well fitted for the service. Electrically heated ovens are widely used for japanning and various other uses. For all these uses the heating elements are subject to burnouts, and spares should be kept in stock at all times.

Various kinds of electric welding are often done in the same plant on different jobs. Arc welding is usually used on large seams or cracks either on maintenance work or on parts making up the product of the plant. Butt welding is often used to weld a small piece of high speed steel to carbon steel, as in the case of tools. Spot welding is usually used on fairly thin sheets to hold the pieces together without making a tight joint. It often replaces riveting at a lower cost and in a great many cases it is better. All electric welding necessarily pulls a high current and the control equipment must be carefully maintained to get day in and day out service without interruption.

Dynamic braking is used with direct current motors for cranes and elevators to control the speed while lowering. The main advantage of dynamic braking is the accuracy of control, and with proper motor and controller sizes, the main point of maintenance is the controller, the contacts of which will require renewals. The energy generated must be dissipated by resistance, and these grids should be kept in stock for replacement if they burn out. A safety limit stop should be provided on all cranes to prevent the hoist from running up too high. This stop usually opens the power circuit and closes the dynamic braking circuit. Lifting magnets are frequently used on outdoor cranes, the main point of maintenance being the controllers which require renewals of contacts.

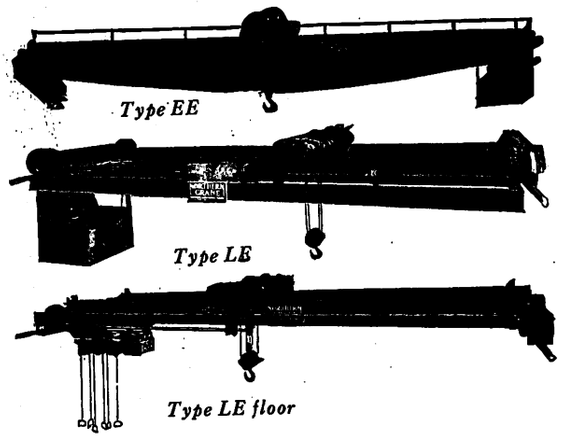
Out in the plant there are only a few small switchboards as a rule, and these should be well guarded with wire netting guards, or else the switchboards should be made perfectly safe with totally enclosed switches or circuit breakers. With the newer types of these accessories a safe installation can be made without the necessity of enclosing it. Insulators on switchboard work should be perfect to avoid any chance of short circuits.

When industrial electric trucks are to be charged, battery charging equipment of ample size and capacity should be installed. The best method is to have all the trucks run into the room set aside for charging at quitting time, and have an electrician stay a few minutes overtime to start the charging equipment. With auto-

(Continued on page 94)

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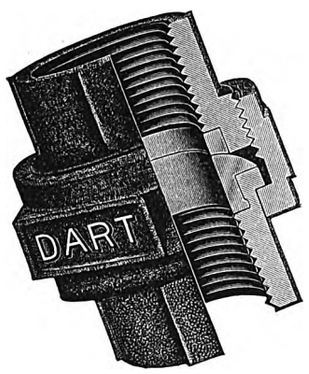


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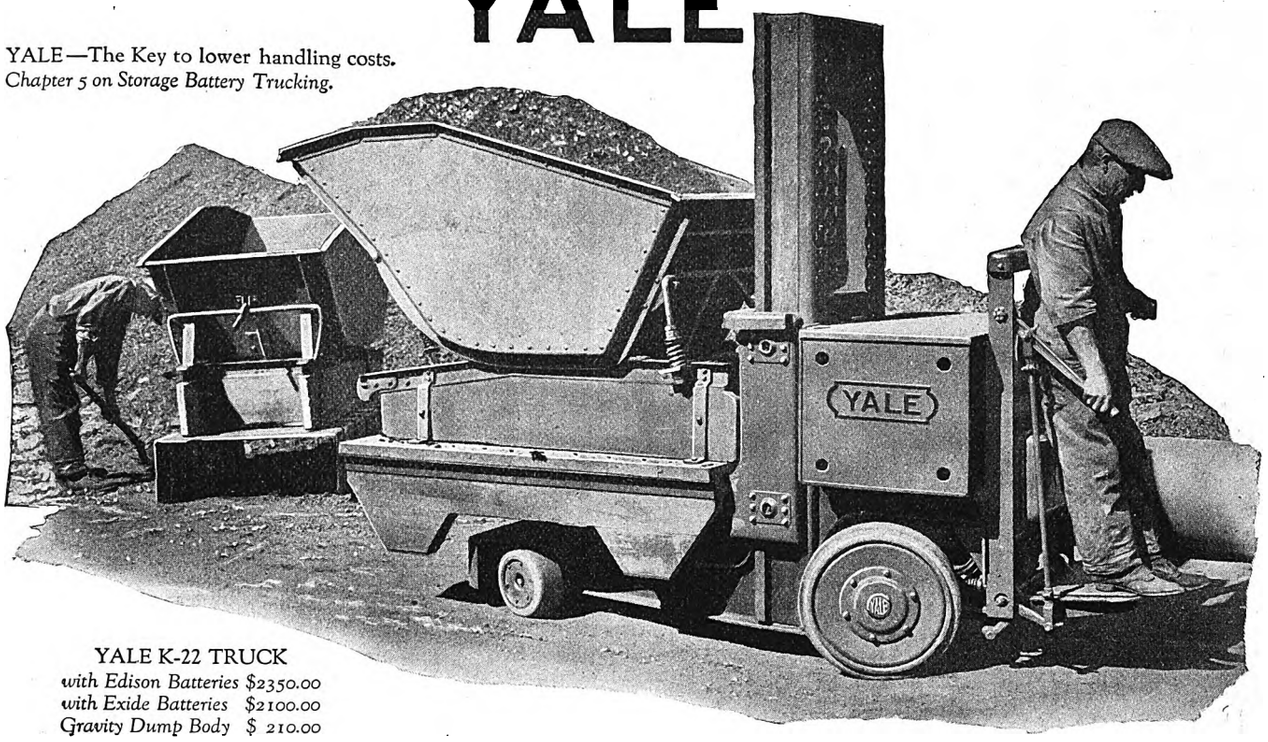
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(*Continued from page 92*)

matic operation the batteries will be automatically disconnected when the charging is completed, and there will be no danger of overcharging. With manual control, arrangements can be made to have one of the watchmen shut off the charging at a certain time. Once a week the electrician should test the water level and refill any cells needing it. The battery charging apparatus will not require much maintenance except oiling of bearings and blowing out dust on the motor-generator set.

Portable electric tools are being used more and more, and new uses for them are being found every day. There are so many jobs where the tools have to be carried to the job that portable electric tools are often a necessity. The most commonly used tools are drills, grinders, blowers and hammers. Owing to the rough usage that these tools receive, there should be a reserve supply in the stockroom so that when one breaks down, another one can be issued and the broken one repaired at leisure. If both A. C. and D. C. current are used in the plant these tools should all have universal motors. The cords should have heavy protection on them and this should not be affected by oil or water. In order to save wear on the cord, reels for holding the excess length of cord are often used, especially on portable machines. These reels save kinking and consequent wear on the cords.

In many plants a master clock system is installed which controls all the "in and out" time clocks, time stamps and watchmen's clocks. On this way all time records are synchronized, but it is of extreme importance that the control equipment be maintained at a high standard so that there will be no breakdowns which would throw all the clocks out of use.

As mentioned earlier in the article an efficient system of inspection is absolutely necessary if the electrical equipment throughout the plant is to be given its proper maintenance. A daily report to the plant engineer's office shows up places that need immediate attention and gives an excellent record of each piece of equipment after the information is transferred to the card index covering all equipment.

THE vigorous start made in construction work this year is indicated by the figures covering "floor space" as compiled by the F. W. Dodge Company. Contracts awarded in January represented nearly 57 million square feet of new floor space as compared with 43 million a year ago. January contracts were at the annual rate of 684 million square feet. In January, 1923, contracts were at the annual rate of 516 million square feet, while the actual figure for 1923 was 592 million, a new high record.

Should building show the same trend during 1924 as during 1923, when the total for the year was nearly 15 per cent larger than that indicated by the January 1923, rate, the total floor space contracted for during 1924 would amount to 785 million square feet, or an increase of nearly 33 per cent over last year.—*Alexander Hamilton Institute.*



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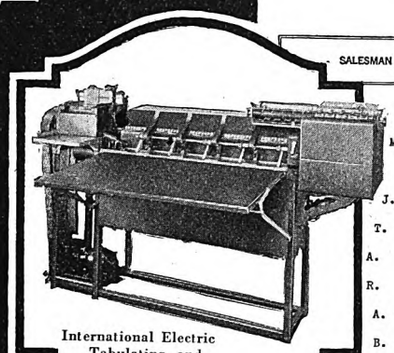
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International Electric Tabulating and Accounting Machine

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BY SALESMAN

APRIL

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	21,416 83	5,716 80	15,700 03	11,272 60	4,427 43	28.2	1,789 83	11.4	2,637 60	16.8
M.	17,497 30	3,873 20	13,624 10	9,577 74	4,046 36	29.7	1,171 70	8.6	2,874 66	21.1
	15,753 81	1,160 21	14,593 60	9,135 56	5,458 04	37.4	1,984 75	13.6	3,473 29	23.8
J.	12,227 83	2,116 08	10,111 75	6,613 15	3,498 60	34.6	879 72	8.7	2,618 88	25.9
T.	10,110 70	310 40	9,800 30	6,713 17	3,087 13	31.5	774 21	7.9	2,312 92	23.6
A.	9,572 81	1,987 49	7,585 32	4,839 41	2,745 91	36.2	963 37	12.7	1,782 54	23.5
R.	8,242 18	3,416 20	4,825 98	3,373 34	1,452 64	30.1	690 08	14.3	762 56	15.8
A.	7,731 50	140 10	7,591 40	4,919 39	2,672 01	35.2	1,169 14	15.4	1,502 87	19.8
B.	7,270 21	373 20	6,897 01	4,655 43	2,241 58	32.5	737 98	10.7	1,503 60	21.8
mond, S.	6,413 71	715 20	5,698 51	4,034 80	1,663 71	29.2	695 62	12.2	968 09	17.0
Brennan, H. A.	5,837 02	336 08	5,500 94	3,487 07	2,013 87	36.6	720 13	13.1	1,293 74	23.5
Reynolds, H.	5,102 60	284 26	4,818 34	3,309 65	1,508 69	31.3	506 21	10.5	1,002 48	20.8
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INTERNATIONAL BUSINESS MACHINES CORPORATION
TABULATING MACHINE COMPANY DIVISION
50 Broad Street New York

Offices in all Principal Cities of the United States and Canada
Members of the National Association of Office Appliance Manufacturers

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A Vital Point for the Reader of this Paper

A B P STANDARD No. 1

"To consider FIRST the interests of the subscriber."

EVERY member of The A B P Inc., of which this paper is one, has subscribed to this and to *nine other* standards covering every department of publishing practice. The A B P label stands for all that is best in publishing; the things which make a business paper one of the essential working tools of the successful business or professional man.

In interpreting Standard No. 1 the constitution bars from membership papers of free circulation, publications which are owned directly or indirectly by an association or an advertiser; and in the words of the constitution itself, —member papers "must not be organs or mouthpieces of any house or combination of houses to further its or their special interest as against the joint interest of the trade or class."

This assures you of a paper without prejudice or bias; one which must be independent of any consideration other than the common welfare of its field.

Because such a paper must have a legitimate PAID circulation, its control is wholly in the hands of the subscribers. The subscribers determine whether the paper shall live or die by giving or withholding their subscriptions.

This is not true of the paper with a circulation controlled by the ones who issue it; which goes to you whether or not it is needed or wanted. The obligation of such a paper necessarily is to its advertisers or whatever interests may be back of it.

The A B P type of paper *must* earn and deserve your approval, — you control its circulation, its life. It *must* render you adequate service; it *must* fight your just battles; it *must* deal fairly with every factor with due regard to the rights of other factors. Enlightened selfishness justifies the fullest support of such a publication.

Standard No. 1 is placed first because it IS first in our conception of publishing practice. Everything else is secondary to the main purpose of serving the subscriber with courage and unswerving fidelity.

THE ASSOCIATED BUSINESS PAPERS, INC.

JESSE H. NEAL, *Executive Secretary*

HEADQUARTERS: 220 WEST 42nd STREET NEW YORK CITY

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"Selling" the Company to Prospective Employees

(*Continued from page* 19)

the men and women of Western Electric have been building better telephones, they have done their share in building a greater city.

This, then, is a source of pride with us; though our product is used the world over, we are deep rooted in the life of Chicago—old timers here, in every sense your neighbors.

Here is another advertisement that gives a not too eager invitation to workers seeking a change:

"BRINGING HOME THE BACON"
AT WESTERN ELECTRIC

Every Saturday over a million dollars is put into pay envelopes at the Western Electric Hawthorne Works.

A million dollars to pay the butcher, the baker, the candlestick maker—not to mention the garage man.

Wages at Hawthorne are good and the work is steady. At least that's what thousands of men and women say who have worked here ten, twenty, thirty—yes, and forty years.

It will pay you to keep an eye out for announcements of vacancies from time to time.

How this display advertisement is coupled up with the classified advertisements, stating specifically what kinds of help are wanted is shown by a subsequent announcement from the "want-ad" pages:

THE
LARGEST INDUSTRIAL FAMILY
IN CHICAGO IS
BRINGING HOME THE BACON

at the Hawthorne Works of the Western Electric Co. Each week 30,000 workers share a payroll of more than
$1,000,000

Wages at Hawthorne are good and the work is steady.

Our manufacturing program for this year is the biggest in our history.

To fill these new requirements we need etc., etc.

Another advertisement calls attention to the athletic features:

THE BIGGEST ATHLETIC CLUB
IN THE WORLD

Here's a record that Michigan Boulevard can't match. An athletic club with 31,000 resident members and some more thousands of non-resident members in all parts of the world.

Where? At the Western Electric telephone works at Hawthorne.

Western Electric doesn't believe in doing things by halves. We have one of the biggest industrial plants in the world and it was fitting that we should organize so big an athletic club.

From office boy to manager we work hard and play hard—one big team.

Some of the advertisements were slightly humorous as this one will show:

ALWAYS ROOM HERE FOR HARD PLUGGERS

The picture shows boys at the Western Electric Hawthorne Works testing switchboard cores by plugging them many thousand times. If they plug good and hard, they'll get a better job soon.

And that is true of everybody at Hawthorne. Those who do good work are bound to advance. There are bigger jobs constantly opening up for men and women who can fill them.

The harder they plug, the sooner they make good.

Still another paid a tribute to craftsmanship and gave some startling statistics:

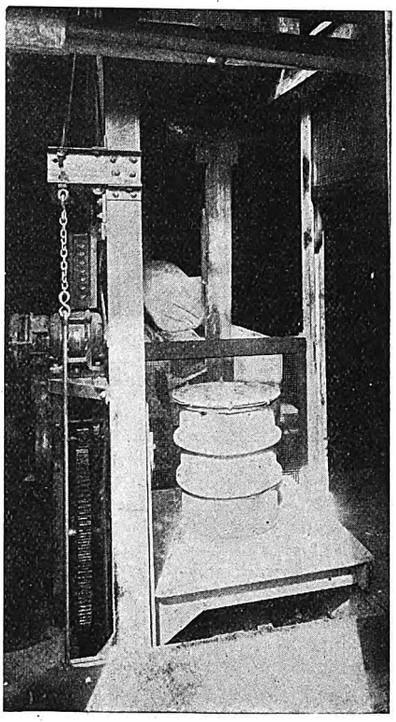
CHAMPIONS

Champion cable makers of the world! Men at the Western Electric Cable Shops turn out 6,000 miles of cable a year. In doing so they use 2,436,000 miles of copper wire.

"Some cable," you'll say—and you're right. It's just one sign of how busy we are at the Hawthorne Works.

For telephones, switchboards and the countless items of telephone apparatus there's a great and growing demand. That brings steady work and steady pay with all kinds of opportunity for advancement.

Not all help can be recruited from the immediate vicin-



Unit Machines for fixed position use, make easy handling to mezzanines, etc. Any capacity, platform, size or speed.

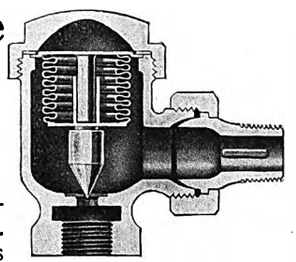
DELTA
Trade Mark
Registered Pat. Off.

Hand and Electric Portable Elevators to handle Boxes, Barrels, Crates, Bales, Etc.

Ask for catalog 105 and let us show you the time and money saving features of the DELTA.

New Jersey Foundry & Machine Co.
90 West St. New York

Check These SARCO Advantages



Noiseless. Factory adjusted. No air binding. No freezing. Prevents water hammer. Self cleaning. Easy to take apart. No blow-holes or defects in castings. Cannot break when connected. Sets at any angle. Wear is distributed over whole area of expansion element.

For vacuum and steam pressures up to 20 lbs.

RADIATOR TRAP SARCO

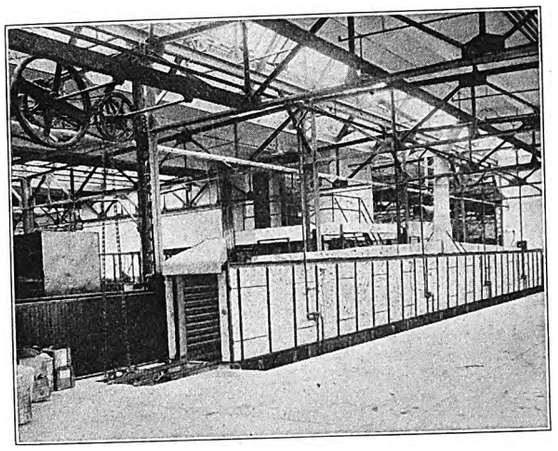
A point for point comparison of the Radiator Trap SARCO with any other make will quickly convince you of all-around SARCO supremacy.

Life-long service goes with the SARCO as well as durability and unusual efficiency.

We have described the SARCO'S many advantages in our Booklet R-114. Write for a copy today.

SARCO CO., INC.
236 Broadway, New York City
Boston Buffalo Chicago Cleveland Detroit Philadelphia

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Baking and Conveying

CONTINUOUS conveyor type, non-elevated oven installed in the plant of a washing machine manufacturer, 79 ft. long with inlet end projecting into the spray room.

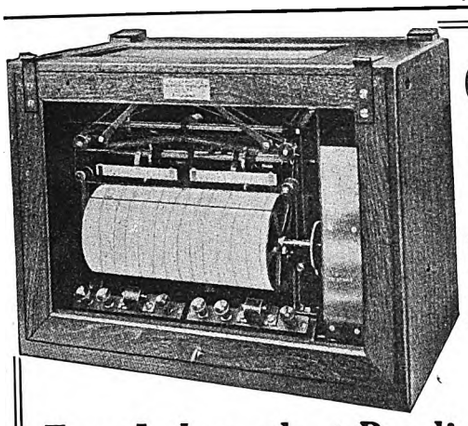
Machines fully baked are delivered directly into the crating and shipping room. It is indirect gas heated and was installed complete with automatic control equipment and conveyor.

Illustrated booklet describing varied installations mailed on request

The PAUL MAEHLER COMPANY

INDUSTRIAL OVEN BUILDERS

2218 W. LAKE ST. CHICAGO, ILLINOIS



Cambridge Electrical CO^2 Recorders Indicators

Four Independent Readings from Four Boilers on ONE Chart

are afforded by the Cambridge instrument shown above. This feature makes it the logical choice for the busy boiler room. By showing four CO2 percentages on one chart time is saved and the possibility of errors in reading is greatly reduced.

Cambridge Electrical CO2 Recorders and Indicators are extremely accurate and rapid in action and practically fool proof. They are entirely electrical —no chemicals to renew—no glass or rubber parts to break or wear out. These rugged instruments may be installed any distance from the flue. Maintenance cost is very low.

Other Cambridge Instruments—Electric Distance Thermometers, Thermo-electric Pyrometers, Optical Pyrometers, Pressure Recorders, Draft Gauges. Write for List No. 157F, containing interesting data.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC)

MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

ity of a plant. One advertisement emphasizes that it draws from a large area. A picture of a huge magnet, lying atop the works shows men being pulled toward it. The copy reads:

IT DRAWS MEN FROM ALL OVER CHICAGO

"A mighty attractive place to work," say 31,000 men and women. They have been drawn to the Western Electric Hawthorne Works by these desirable features:

1. Western Electric is a big concern—the largest telephone manufacturer in the world.
2. And it's still growing—giving opportunities for advancement.
3. Western Electric offers good pay.
4. And steady employment.
5. The Hawthorne plant has ideal working conditions—modern, fire-safe, sanitary buildings, schools, social activities and the biggest athletic club in Chicago.

Safety conditions are given a special advertisement which featured a picture of a fire gong, with the following message:

THE ONLY DRONE AT HAWTHORNE

The fire gong has a lazy time of it at the Western Electric telephone works. What with fireproof buildings and inspections going on all the time to guard against fire, it hardly ever gets into action.

This ought to interest men and women who look for safe working conditions. It is one of many indications of the safeguards to life and health which are the rule at Hawthorne.

And that explains why thousands of people have liked their jobs here well enough to stay from five to thirty and even forty years.

Special advertising is prepared for graduates about commencement time. One of these contains a picture of a boy looking through his diploma which has been rolled into a conical tube.

TO GRADUATES WHO CAN LOOK AHEAD

This is written to the man who has faith in the future, who can see that humble beginnings often lead to great achievement.

If you are not afraid to start near the bottom and work up, the Western Electric Company offers you a far-reaching opportunity.

In Chicago and in a technical and commercial organization which covers the whole world, Western Electric will need big men to carry on its big work through the years to come.

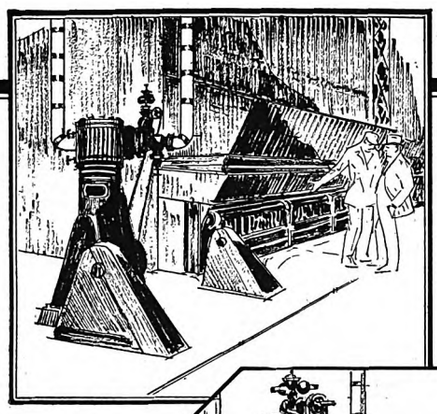
Going after the worker in this manner—giving him some real information about the concerns and working conditions, advantages, prospects—is not a matter of a single advertisement.

It is a phase of educating the worker about his job and needs several lessons.

THE recommendation of the Secretary of the Treasury for reduction of Federal taxes was based upon some important facts confirmed by experience. One is that all very high taxes are grudgingly borne by the taxpayers, and that they yield less revenue, proportionately, and often actually, than do lower tax schedules. There is the natural human instinct to regard high taxes as unfair, and the rich and prosperous who pay them feel as if they were singled out for excessive impositions because of their supposed financial ability to bear more than their relative share of the burden. Ways and means are usually found, most of them strictly within the law, to evade a large share of such burdens, evidence by heavy investments in tax-exempt securities to avoid the present high surtax.

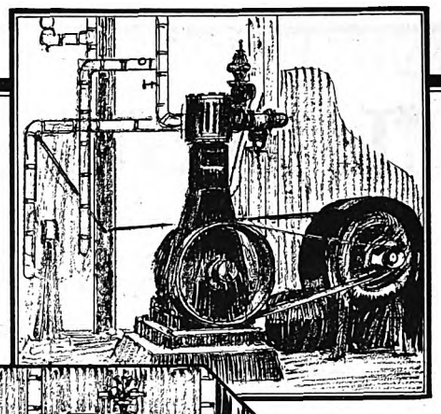
These tax-exempt securities represent loans of capital that are, on the whole, not so productive of wealth as are the loans represented by taxable securities. Much of the money otherwise invested in tax-exempt securities would naturally go into productive enterprises.—*La Salle Extension University.*

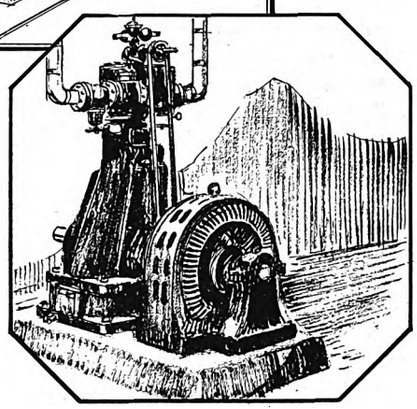
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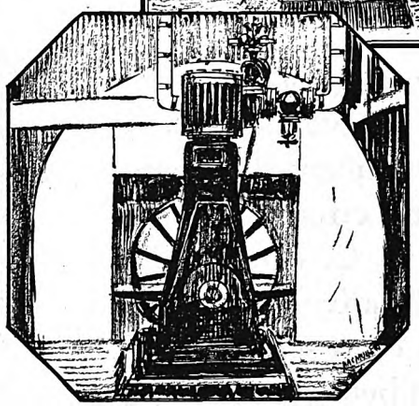


TROY

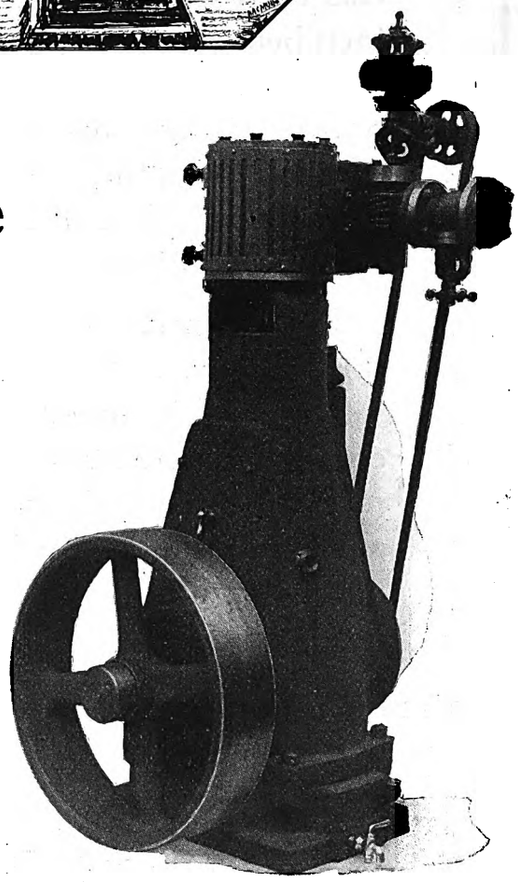
ONLY STEAM ENGINES GOOD ENGINES ONLY







For Every Industrial Purpose



Industrial executives who are scanning production costs closely are also aware of the savings that can be effected by the proper selection of equipment used for power purposes.

The Troy Engine meets every requirement of modern boiler room practice. Whether for driving stokers, fans, blowers, pumps, compressors, as auxiliaries to the larger prime movers, or direct connected to electric generators the Troy is built for economical operation and hard usage, due to day in and day out service.

For the plants equipped with high pressure boilers and superheat the New Troy has been developed. Thus Troy has kept pace with engineering progress. The new Troy is especially adapted to drive modern stokers. Of extra heavy construction with large overload capacity, it meets every demand for greater power in smaller space.

All Troy Engines are equipped with the Troy system of Automatic Lubrication, which supplies each bearing with an abundance of oil. Also, the Balanced Valve which relieves the cylinder of any condensation—assuring absolute safety.

Write for catalog

Made in sizes from 2 to 200 B. H. P.

TROY ENGINE & MACHINE CO.
TROY, PA.

TROY ENGINES

Dependable Power with Absolute Safety

When writing advertisers please mention Industry Illustrated

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"LONGLIFE"

used on the

Largest Conveying Unit in the World

The longest straight-run conveyor system yet conceived is now being completed by the H. C. Frick Coke Company. It will carry coal on a series of 48-inch belts from a loading point 400 feet below ground level through a tunnel to tipples nearly four and a half miles distant.

The magnitude of this project, and the solution of its many engineering problems, mark it as the highest achievement in the development of conveyor practice.

THE B. F. GOODRICH RUBBER CO.
Akron, Ohio

Goodrich

TRADE MARK LONGLIFE

"LONGLIFE" Conveyor Belts
"Best in the Long Run"

American Industry and the Immigrant

(*Continued from page* 27)

terest, great hope and often tragedy. Last year, for example, 100,000 emigrants passed through the principal railroad station of Paris, largely from countries east. They had staked everything on this one great adventure, but many had been cheated and robbed en route. One large group had been sold Paris subway tickets, at the price of railroad tickets to the ports, by some fake railroad agent. Some of their more fortunate companions, on arrival at the port, could go no further, for their money had been spent, their tickets lost or the monthly quota (not more than 20 per cent of the yearly allowance) was full. And this meant a long wait in a strange city, where sharks and grafters are ready to fleece the poor emigrant twenty-four hours per day. And so it is in all embarkation cities.

I shall never forget my visits to the homes of emigrants in the interior. The houses of the little villages in Czecho-Slovakia were tinted white, blue, yellow and green, and had picturesque straw-thatched roofs. Little girls in long dresses were running around taking care of the geese. "Nazdar!" ("Good-luck!") they called as we drove by. A stream of people were coming home from church. The women were dressed in the most beautiful costumes, with elaborate embroidery. The men wore heavy wool or felt trousers, and wool or leather vests and coats, also beautifully embroidered, and hats with the inevitable flower or feather stuck in the hat bands. The fields were fertile, the wonderful Tatra mountains shone white in the distance, and all was peace. This was a Sunday morning in Slovakia!

A month or two later on Monday morning some of these same people would be working many hours per day in blue overalls in the steel mills or coal mines. What a contrast! Between these two extremes there is a great gap. Many people of Europe are trying to fill up this gap with merciless exploitation, and, unfortunately, exploitation does not cease when the immigrant arrives in "the land of the free."

When will we realize that the way in which we treat these immigrants in America determines not only their future value as industrial workers and citizens, but also that it has a tremendous influence upon the countries of Europe? Many of them eventually return and settle down near their old homes. They carry back American ideals and methods, good or bad, according as they have found them. In southern Italy my attention was arrested one day by a sign: *"Coney Island Barber Shop."* I talked with the proprietor, a returned emigrant, and found that his greatest impression of the United States was Coney Island. He had returned with Coney Island ideals, instead of the best American ideals.

In many other countries I discovered similar illustrations. And the more I conversed with these emigrants the more convinced I became that it was largely our fault rather than theirs that they had not absorbed the best in America. Many others, however, have gone back with the "real thing," and are exerting a powerful influence for good in their respective communities. And it is encouraging that some of our best immigrants never return, but remain here, gradually fusing into

(*Continued on page* 102)

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National Biscuit Co. uses 38 Stuebings!

The question no longer is "Will lift trucks save us money in material handling?" For industry is daily proving that there is no question about it!

The only thing that remains to be determined is "How can we save the *most* money?" And that question, also, is rapidly being answered.

Five years ago, on April 17, 1919, the National Biscuit Company started to answer that question for themselves. They purchased their first Stuebing Lift Truck and put it to work in their New York plant. Side by side with other lift trucks this Stuebing did *more* than its share of the lifting and hauling, for it had no days off in the repair shop.

It carried their heaviest loads without a whimper; and its positive-acting hydraulic check eased the loads to the floor with velvety smoothness.

What was the natural result? Another order for Stuebings! And order followed order until, today, *38 Stuebings* are in constant uninterrupted service.

Does the National Biscuit Company know what lift trucks will save them the most money? 38 Stuebings are proof that they have answered that question beyond the shadow of a doubt!

If you want to make all the saving possible, with *your* material handling equipment, specify Stuebing Lift Trucks and "Steel-Bound" Platforms. Use the coupon below and let us send you a copy of our new 36-page catalog.

THE STUEBING TRUCK COMPANY
Cincinnati, Ohio Cornwall, Ontario
Branch Sales Offices in all Principal Cities



8 Reasons Why You Should Buy a Stuebing Side Lift

1 *Side Lift*, for convenience. A lifting and steering range exceeding that of any other side lift truck built.

2 *Easy Lift*, for power. Stuebing engineers have developed a lifting leverage that far surpasses anything heretofore accomplished. Smoothly working parts are also a factor. An anti-friction bearing in fork column makes steering easy.

3 *Single Lift*, for speed. With a single stroke *one man* can lift with ease a load that, heretofore, required several strokes, with effort.

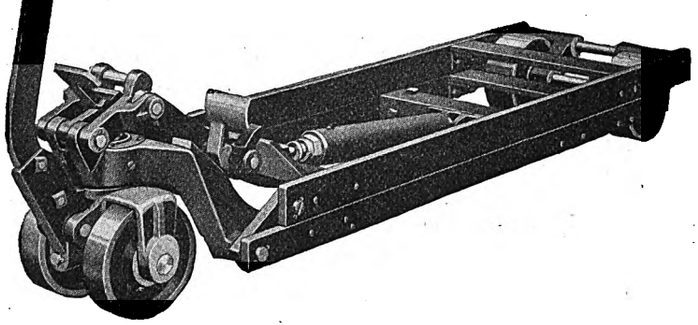
4 *High Lift*, for emergencies, to clear inclines, elevator crossings and for rough floors.

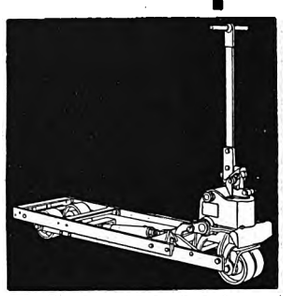
5 *Four Wheels*, for stability. Prevents bulky or high loads from upsetting. Protects floors and provides longer life to truck.

6 *Steel Construction*, for great strength. *Simplicity, few parts.* Standard Stuebing construction assures the long wear and low upkeep that make your lift truck savings *real.*

7 *Safety.* The only trucks with double-acting safety device. Counterbalanced handle provides quick and easy operation. Handle cannot fall to the floor or fly up.

8 *Guarantee.* Warranted against breakage of any part through defective workmanship or material, regardless of the number of years in service.





The Stuebing Multi-Lift for use where loads are heavy. Its lifting leverage gives one man the lifting strength of 88 men, and it pulls easily on its Hyatt-equipped wheels

StueBing
LIFT TRUCK SYSTEMS

© 1924 T.S.T. Co.

The
Stuebing Truck Co.
Cincinnati, Ohio
Without obligation, please send me full information concerning: Single Lift Truck ☐ Multi-Lift Truck ☐ Side Lift Truck ☐ "Steel-Bound" Platforms ☐

Name.....

Address.....

Nature of Business.....

NO OTHER LIFT TRUCK IS BUILT LIKE A STUEBING!

When writing advertisers please mention Industry Illustrated

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(*Continued from page* 100)

the economic, social and political life of the nation.

In Prague I met a Slovak who had worked in New York, Boston, Detroit, Philadelphia and Scranton. In the last city he had learned most of his English. He proudly produced the very book he had used in the Y. M. C. A. night school. "See," he said, "this my best book! Some day I be citizen—then I get better job, and vote for President!"

It is fascinating to trail the immigrants from Czecho-Slovakia, the new republic of 14,000,000 people; from Poland—now an enormous country of 150,000 square miles and 30,000,000 inhabitants; from Jugo-Slavia, composed of Serbia, Croatia, and old states of Austria-Hungary, with over 12,000,000 people; from Austria and Bulgaria, greatly contracted by the peace treaty; from Turkey and Greece; from the new Baltic States, now independent republics; from Scandinavia which furnished so much of our earlier emigration but where the governments now prefer to have their people stay at home; from Germany, hard-pressed, but boasting two of the greatest emigrant stations in the world. The one at Hamburg contains 30 buildings and covers many acres. Bremen is almost as large. In 1913, the last normal year, over 239,000 emigrants embarked from the latter port. Holland, Belgium and France send us few immigrants, while most of the people from Spain and Portugal go to South America. As for Italy, her greatest exports are emigrants. In 1913, she sent over 428,000 across the seas. Last year her nationals forwarded to their mother country approximately $250,000,000 earned in American industries.

This is all the more surprising when we consider that most of the emigrants from Italy and other countries are peasants. Yet they undertake the most unskilled tasks in our mines, quarries, factories and construction camps. With all their faults, they have their good qualities and we can ill afford to do without them in some of our unskilled occupations.

Let no one get the idea that it is a quick jump from Balkan peasant to West Virginia miner! The prospective emigrant must secure all sorts of permits—medical, penal and military certificates before he can, after considerable delay, secure his passport. Then he must obtain a vise from the nearest American consul, who may be two days distant. After selling all his precious possessions, except what is essential for the journey, he weeps his farewells and sets out on the great adventure. It takes him far longer to reach the sea port than the ordinary traveler, and at every frontier he must get out, day or night, and submit to passport and baggage examinations. At the port he is housed at a company or "private" hotel—where he is thoroughly "deloused" and examined by steamship company doctors. The United States Health Service representative gives the final examinations and "bill of health" to the ship, and, at last, our emigrant crosses the gang plank. After a hard trip, he reaches Ellis Island, passes a literacy test and several medical examinations. If he is not debarred for any one of several dozen reasons, or subjected to "S. I." (examination by a board of "Special Inquiry"), he passes on to the money-exchange room, railroad room, and then aboard a ferry which takes him to New York City or a Jersey railroad terminal from whence he takes a train inland. Finally he arrives, tired, discouraged, speechless, with many forebodings of the

Made for maximum service, not merely the average

TRADE JENKINS MARK

Jenkins Bros

Good valves are essential to all efficient piping systems

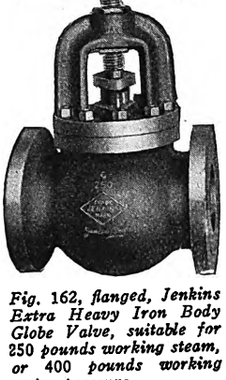


Fig. 162, flanged, Jenkins Extra Heavy Iron Body Globe Valve, suitable for 250 pounds working steam, or 400 pounds working water pressure.

No detail deserves more consideration in the design of any piping system than the valves. Fortunately the importance of safe, well-made, sturdy valves is fully recognized.

Engineers and others responsible for the layout of piping appreciate this importance. They know its unquestionable value and for this reason are standardizing on Jenkins Valves.

No other single item contributes more to the satisfaction and ultimate economy to be derived from a power plant, plumbing or heating system than do Jenkins Valves. The accompanying illustration is a typical Jenkins Valve—just one of the Jenkins line.

Specify Jenkins Diamond Marked Valves. They are built for service.

JENKINS BROS.

80 White Street, New York, N. Y.
524 Atlantic Avenue, Boston, Mass.
133 No. Seventh Street, Philadelphia, Pa.
646 Washington Boulevard, Chicago, Ill.

Always marked with the "Diamond"

Jenkins Valves

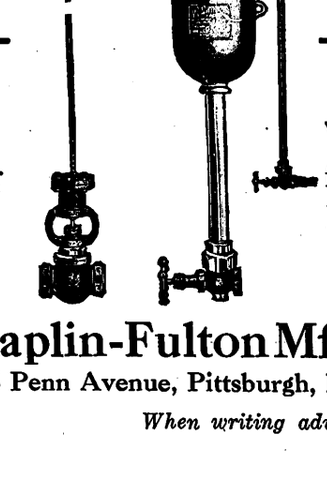
SINCE 1864

Works for You Night and Day

The Vigilant Feed Water Regulator takes no time off—it needs none. Once installed it's always on the job, automatically maintaining a constant unvarying water level, conserving your fuel and preventing explosions.

Why not eliminate the uncertain human element and assign the responsibility for correct boiler feedings to the never failing Vigilant? Its gravity operation makes it absolutely dependable; it's lack of floats, tubes and diaphragms makes it reliable.

Write for our engineers to call and make recommendations.



Vigilant Feed Water Regulator

Vigilant for Your Benefit

The Chaplin-Fulton Mfg. Co.

28-36 Penn Avenue, Pittsburgh, Pa.

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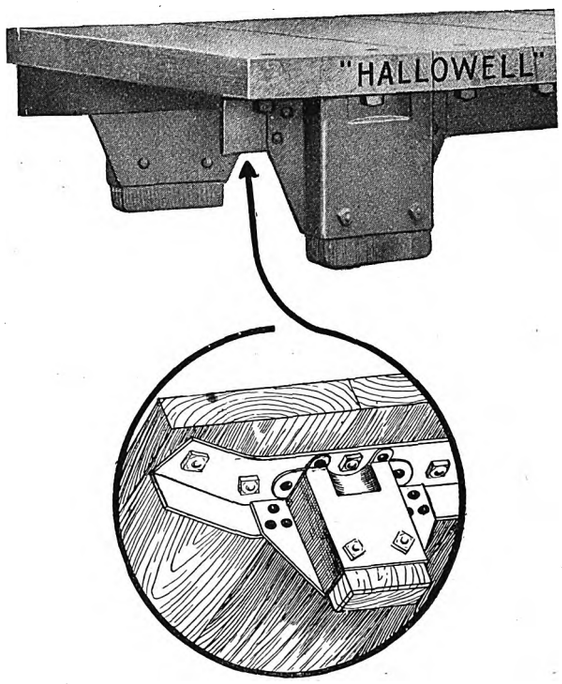
future. It is, indeed, a long, tedious, but necessary process—this changing from emigrant to immigrant—in one sense a "survival of the fittest!"

Though there are many people in Europe who exploit the emigrant, there are a few agencies to protect and serve him. One of these few is the Y. M. C. A. There are American or native secretaries in most of the countries of origin promoting general Y. M. C. A. work, and also advising emigrants, where necessary. This is done without in any way stimulating or retarding emigration. Other secretaries serve the wanderers at frontier towns and ports of embarkation. Still others promote educational and recreational activities on board some of the ships and assist the immigrants at Ellis Island and other ports of entry. Several hundred secretaries cooperate in American cities through classes in English and Citizenship attended by over 100,000 last year; indoor and outdoor lectures enjoyed by over 1,000,000; and many other activities which make up a comprehensive program of Americanization.

We could better understand the immigrants who are now coming to us of we could picture more clearly the present conditions in their fatherlands. Great changes are taking place. There is everywhere a tendency toward greater democracy. I visited a splendid boys' camp in Poland with headquarters in one of the Czar's old hunting palaces. The main quarters of the palace were being used as dormitories and the old wine cellar was the dining room. In Czecho-Slovakia, I witnessed one athletic meet which lasted for a week, and during which there were ten thousand participants, and 125,000 spectators every afternoon. I spent one day in a refugee camp, near the Bolshevik frontier, in Poland. There were 12,000 refugees in camp, some of them clothed in flour bags or burlap. A Red Cross girl told me she had given out the last clothing available, and did not know where more was coming from, yet the refugees were pouring in at the rate of several thousand per day. Many of these people had been to America. Here they thought they were Bolshevists. They had returned to Russia to enjoy Bolshevism at its best. They had "enjoyed" quite enough of it. "If ever I get back to America," said one, "I am going to get a job and become a good citizen!"

In other countries, as well as in Russia, people have had no good food or clothing for a year or more. One of our workers just returned from Petrograd tells of his first-hand impressions of the terrible conditions. Many students are endeavoring to live on one meal a day.

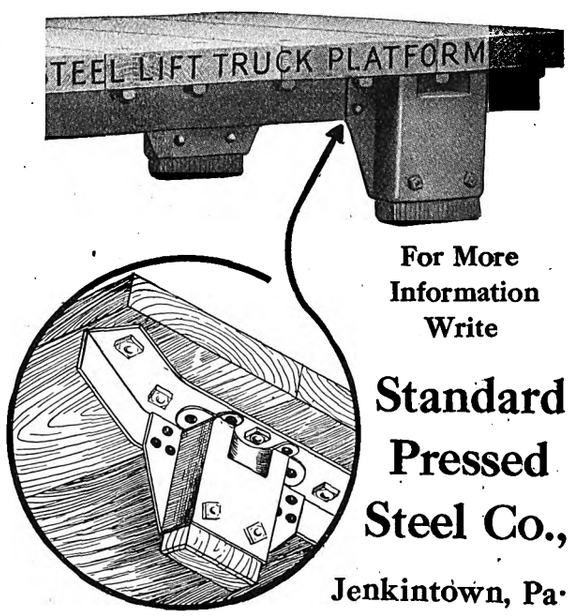
Were it not for the work of the European Student Relief, thousands of students in many countries would starve. The president of one Russian University earns in five months just enough to buy one pair of shoes! Two students often wear the same suit on alternate days. In many ways, the needs of Europe today are far greater than during the war. The Quakers in a single week in Germany fed over a million children in 8,000 different centers in 1640 different cities. Those who are suffering most in Germany, Austria and Russia are the very people who *least* wanted the war, and who *hate* Bolshevism with a hatred far beyond any hatred which we can understand! The only way to improve conditions in these countries in a permanent way is to help the better and more democratic elements in the population to win their great fight against the old forces of militarism and greed. And in this fight the returned



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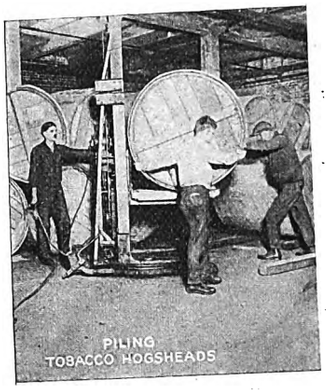


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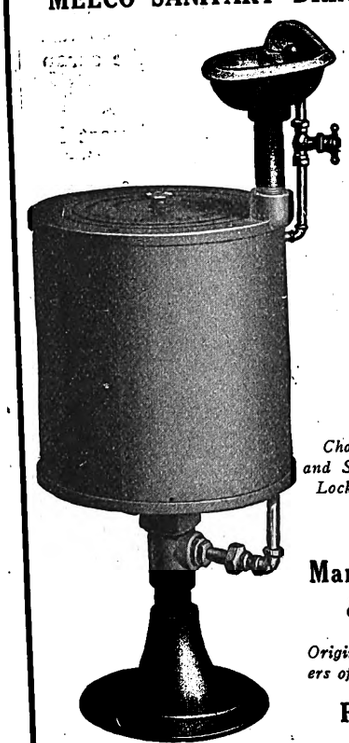
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emigrant, who has experienced American democracy, is frequently a real leader.

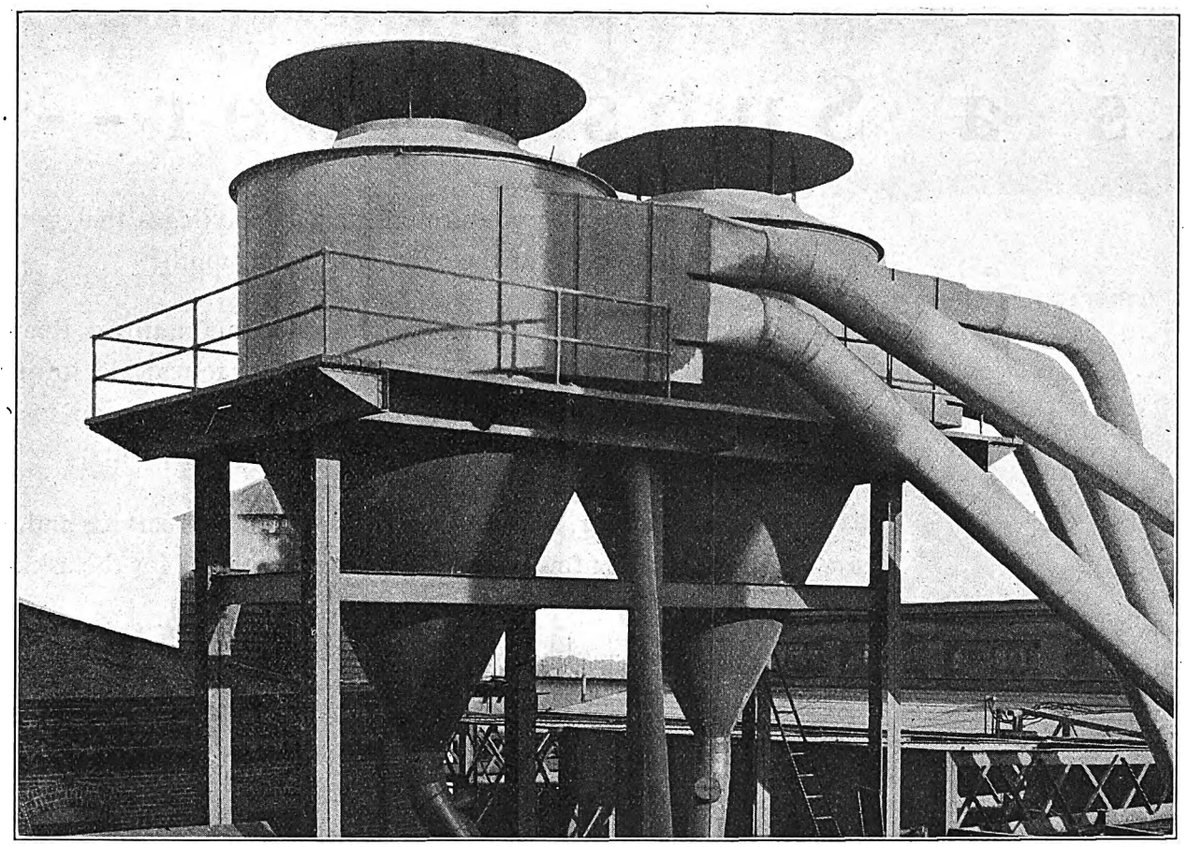
Europe, as I look back upon it, seems a mass of desolation, of international hatred, misunderstanding, distrust, yet, it is a vast area no part of which is without tremendous possibilities. Whether for good or ill, will be determined largely by America's attitude and actions now and in the future years. Europe is not in eclipse. The work of Herbert Hoover, the relief organizations and the great Christian and social agencies like the Y. M. C. A., the Y. W. C. A., the Quakers, the Red Cross, and the World's Student Federation, with its splendid student welfare program, has done more to restore confidence and faith in America than any thing else. These are the agencies which have held up before the eyes of suffering Europe the *real* America, the America of unselfishness and good-will to all people regardless of race, creed or nationality. These are the agencies which are making many people in Europe thankful that America lives. Sooner or later we will realize that we must go to Europe even to mind our own business! A high government official said to me, "We shall never forget that you, who have been our enemy, have fed our starving children and given clothes to our suffering students." For the good-will which lies behind such a statement as this we should be very thankful.

We owe this good-will, in no small measure, to many returned emigrants who, as paid or volunteer workers in many of these organizations, or in private life, have helped to interpret the real America. This has increased my conviction that one of the best ways to help Europe, as well as America, is to treat our immigrants in just and brotherly fashion, in factory and community, to *attract* rather than compel them to citizenship, and to recognize and utilize the splendid qualities which they bring.

A LENGTHY series of vivid and striking educational motion picture films, depicting the mining, preparation and utilization of the various mineral materials, is made more readily available to the public through a new system of distribution, arranged by the Department of the Interior, by which the many industrial films made by the Bureau of Mines may be obtained through state or sectional centers of distribution.

Nearly a hundred educational films have been prepared in the past few years by the Bureau of Mines in coöperation with industrial concerns. The demand for these films for showing by educational institutions and civic bodies has become so great that the original plan of centralized distribution from the Pittsburgh Experiment Station of the Bureau of Mines has become inadequate. A selected list of the best of these films is now made available at twenty-seven coöperating agencies located in the different states. The films relate to coal, petroleum, sulphur, iron, asbestos, zinc, marble, copper, natural gas, and other minerals. A series of films depicts most vividly such industrial processes as the manufacture of oxygen, the making of fire-clay refractories, the manufacture of automobiles, the methods of compressing air, the quarrying of limestone, etc. Other films illustrate dangerous and safe practices in mining, efficiency in the combustion of coal, the utilization of water power, and the operation of a gasoline motor.

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BRILL COMPANY REDUCES PAYROLL $36,000 ANNUALLY CARRYING WOOD WASTE BY AIR

J. W. Rawle, Vice-President of the J. G. Brill Company, Philadelphia, Pa., says:

"As the largest builders of electric railway cars in the world, we have always been quick to introduce into our plant devices which would promote the safety and health of our employees and at the same time make for greater efficiency in our production. With both of these thoughts in mind, we installed a Sturtevant dust and waste collecting system in our wood working shop at our Philadelphia plant. Our equipment now consists of five Sturtevant Blower fans driven by motors ranging from 50 to 150 horse power which gather the waste materials from 73 circular and band saws, planing machines, sanding machines, and other wood working machines.

The waste is drawn through pipes ranging in size from 14 inches down to 7 and 8 inches—and in length from 60 to 150 feet and is first sucked and then blown to two separators, 44 feet in height, which drop the waste directly into any or all of the four fire boxes in the power house. It is impossible to estimate the tonnage of waste material handled, but an idea can be gained when it is known that better than 6,000,000 feet of common lumber, teak, mahogany, rose wood, and other woods go through the various machines each year.

The saving in the health and safety of the workingmen is not calculable. Needless to say, keeping the air free from flying particles and fine dust has made our wood working plant a better place to work in and has reduced our labor turnover. Without the equipment we would have to have one man for every two machines to gather up and remove the waste. This means a saving of 36 men or approximately $36,000.00 a year in wages.

Without the waste collectors the machines would have to be stopped every so often to be cleaned. Conservatively estimated, this would mean a reduction in production of 15%. Further, the waste material is so effectively removed that it is reflected in fire insurance premiums as well as in accident prevention. It would be impossible to operate an efficient and safe wood working plant without such equipment as Sturtevant have provided us with here. In our long acquaintance with the equipment, our experience has been that it is always satisfactory in every way."

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Teaching Modern Mining Methods

By Robert H. Moulton

AS a result of the constant disorders in the coal mining industry, between operators and miners, a great effort is now being made to stabilize the production of coal. When stabilization comes the whole country will be benefitted. There will be fewer mines, and, of course, fewer miners; but the miners will be skilled workers, earning steady wages, and will be happier. The whole industry will be raised to a higher degree of efficiency. A tremendous amount of capital now invested in mines operating only a part of each year, will be available for other enterprises. Strikes, which are due primarily to unsteady labor, will at least be fewer.

Another important reaction resulting from the elevation of the coal industry will be in the personnel as a whole. Mining as a vocation, will appeal to many more

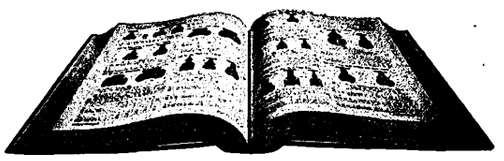


men than it does now. Constantly recurring disorders and unsteady work have kept many young men from the mining fields. That it has a strong appeal as a profession is agreed, and stabilization will strengthen its appeal.

Progressive educational institutions realize this condition. An established coal industry opens up to the coal mining schools opportunity to educate the young mining engineers needed in one of the greatest productive industries of the world.

Occupying a unique position in so far as opportunity is concerned, is the Carnegie Institute of Technology, Pittsburgh, Pa. At Carnegie, a coöperative department of mining engineering has been established for several years. The department has courses, not only for mining engineers, but for young miners desiring to train as mine foremen and fire bosses—for young men limited, perhaps, in means and education, to become executive workers. All of the work done by the department of mining is on a coöperative basis with two units. One is in connection with the United States Bureau of Mines, the experimental station of which is located adjacent to the college and which is the largest and most modern station in the world. The other association is with an advisory committee composed of mine operators and engineers in the Pittsburgh district.

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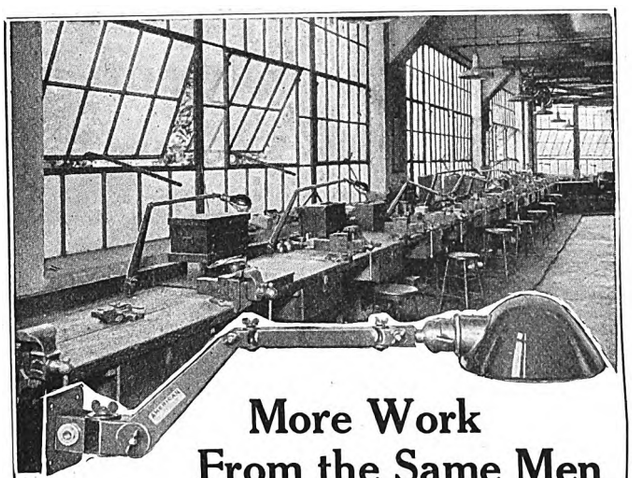
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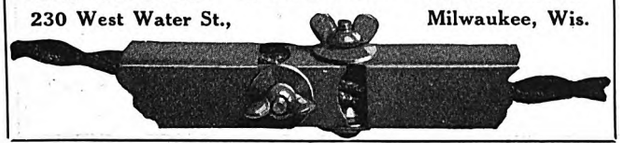
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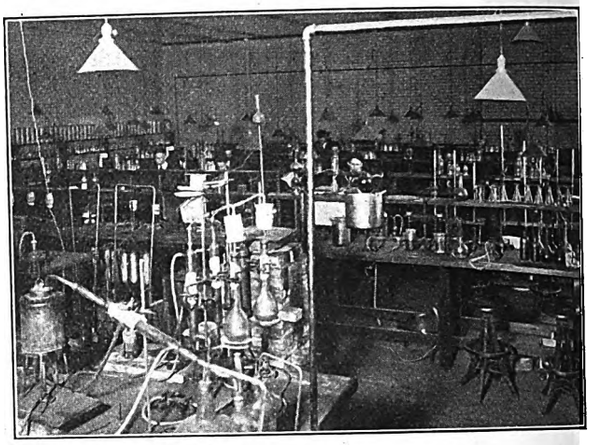
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numbering 20 members, advises on all matters pertaining to the mining courses. This advice aids in giving to the courses of instruction the practical and business features which are necessary to develop the type of mining men especially needed at this time.

In the coal mining courses at Carnegie, students are not taught solely by the text-book method. Instead they are given real experience in mining, and they don't have to go any farther than two flights of steps to get actual drilling and excavating experience. Beneath the college of engineering, which houses the department of mining, is the only mine in any college east of the Mississippi River.

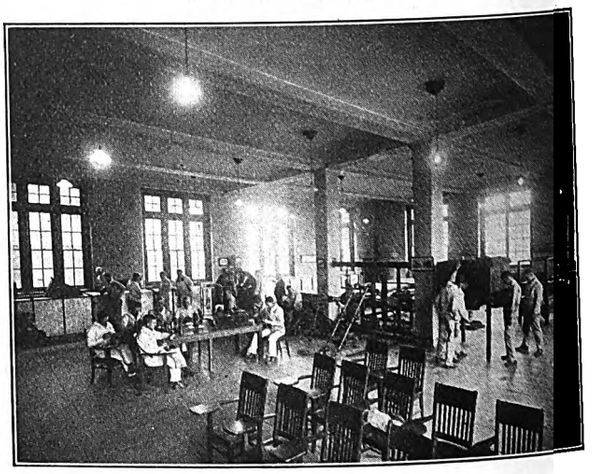
The tunnel of the mine runs off the third or bottom



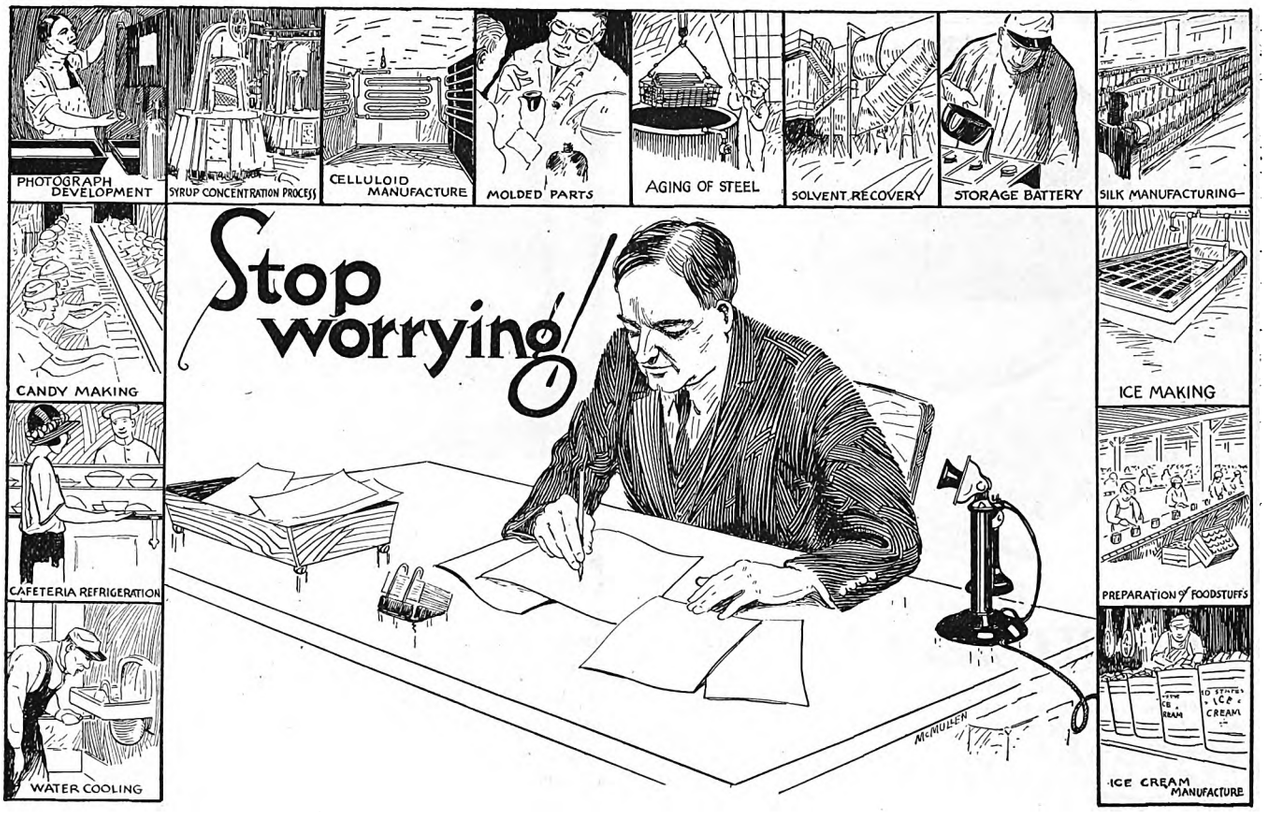
bench, of what serves as a heavy mining machinery laboratory. A 42-inch gauge track with trolley wire accessories extends, at present, 200 feet into a timbered and concreted tunnel which enters the hillside in the direction of the campus. The equipment of the mine consists of a trolley locomotive, storage battery locomotive, coal mining machines, forge, welding apparatus, modern lights and heavy electric drill, etc. From the mouth of the tunnel the track extends out of the laboratory and 75 yards along a hillside. The mine tunnel runs through clay and solid rock. Drilling through an upper half of rock and the lower half of clay and extension of the tunnel are regular parts of the mining course.

Another important development in this industry, a study of which had gradually made mining a science, has been metallurgical mining. During the last half

(*Continued on page* 110)



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This executive was surrounded by practical solutions of his problems!

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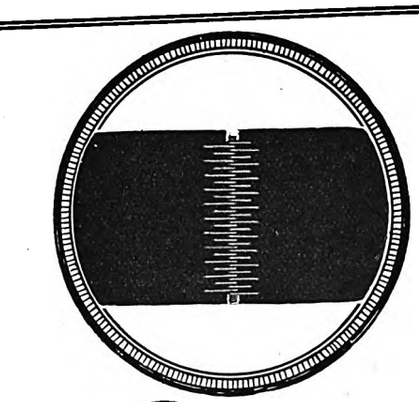
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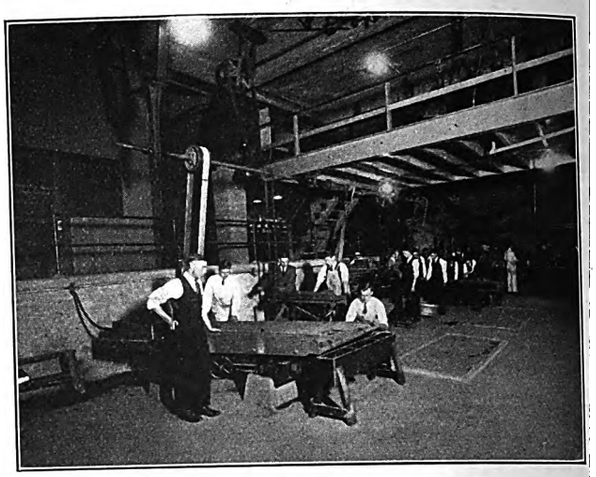
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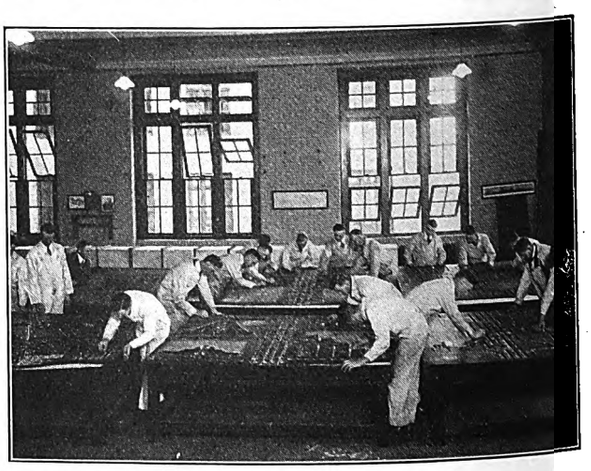


(*Continued from page* 108)

century there has developed a line of work, usually carried on at or close to the mines, but which may properly be considered as belonging to either mining or metallurgical engineering. Material as mined may and usually does contain a variety of minerals, some of them in undesirably large quantities. The important art of coal washing or dressing is at the present time undergoing development.

The art of ore-dressing consists in partly separating by means of various expedients, desirable minerals from undesirable so that only the former may be subjected to transportation charges or to metallurgical processes for extraction. By utilizing various characteristics of minerals—brittleness, friability, specific gravity, electrical conductivity, magnetic attraction, adhesiveness, etc., in a score of ingenious ways, ore-dressing helps to convert otherwise valueless or undesirable material into highly profitable ore or mineral. It is this art that has made possible much of the immense growth of the mining industry during the last 30 years. Comparatively few metalliferous mines are without concentrating mills as an indispensable adjunct.

As the result of the recent developments in mining, the mining engineer must have an exceedingly broad and thorough technical training. In addition to his knowledge of underground work, he should be able to design, construct, and operate a treatment plant which shall furnish the ore to the smelter or the coal to coke ovens in the best possible condition for subsequent treatment. Mining students are now given a knowledge of the metallurgical processes by which the metals are extracted from



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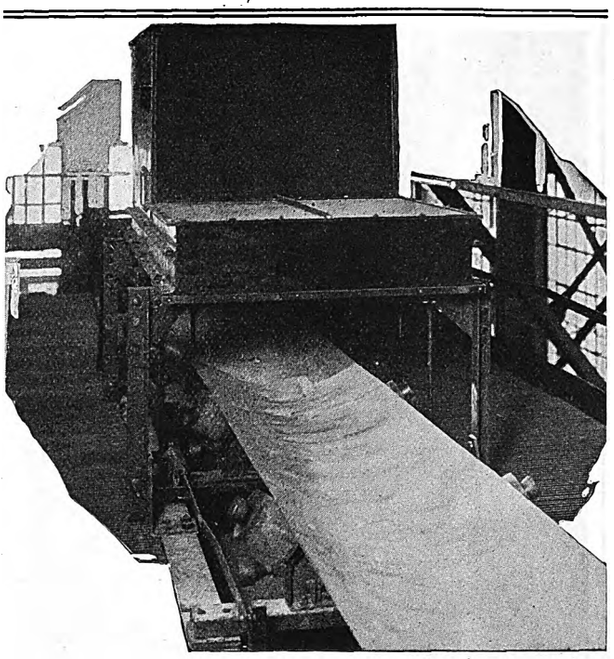
the ores. Laboratory work is used to stimulate powers of observation and reasoning; and some practice is given in surveying.

The field is large, so large that mining engineers frequently find it desirable to specialize in some particular branch. One man makes a specialty of examining and valuing properties; another man becomes expert in economical operation of mines; while a third makes a special duty of the geological side of mining. Each line offers ample opportunities to a capable man, and the industry of mining must necessarily grow with the growth of population and civilization.

THE idea of obtaining steam power from the heated center of the earth is not practicable at the present time, according to Dr. Thomas T. Read, of the Department of the Interior, who, with F. C. Houghten, of the research laboratory of the American Society of Heating and Ventilating Engineers, has prepared for the Bureau of Mines a report on the cooling of mine air. In descending beneath the surface of the earth the temperature increases continuously with depth at a rate varying from one degree Fahrenheit for 70 feet in depth to one degree in 250 feet, according to the region where it has been measured. Men have ascended over five miles above the surface of the earth: if they could go five miles below the surface in a shaft that deep, a region of high temperature would be reached, and it would seem as though it ought to be possible to utilize that heat as a source of power, free and perpetual. Sir Charles Parsons, the inventor of the steam turbine, has suggested that it is possible, but Dr. Read considers that the difficulties involved would make the power thus obtained too expensive to compete with coal.

The principal difficulty is not the cost of penetrating to so great a depth (though a shaft 5 miles deep would cost $5,000,000 or more), but the fact that the amount of heat that can be derived from hot rock is not proportional to its temperature, but is limited by the conductivity of the rock. Comparing the heat with water filtering through porous rock, it is evident that the amount of water that can get through in a given time is not dependent upon the amount of water available, or even on its pressure, but depends chiefly on the porosity of the rock. The heat conductivity of rock is low, and in order to get any considerable quantity of heat through in a unit of time the area of surface exposed must be large.

The second important difficulty depends on space; the heat is available five miles below the surface, but it can only be usefully employed on the surface and how to get it there without losing most of it on the way is the problem. One suggestion is to pass water down, and circulate it through large galleries at the bottom, thus giving it time to take up the heat, even at the slow rate of transfer that exists. This would give us water at a high temperature and pressure, but at the bottom of the shaft, where it is no more useful than ice is in the polar regions. In rising to the top of the shaft, the hot water would cool down at about the same rate as it heated up in descending. Even with extremely efficient (and expensive) heat insulation on the up-going pipe, so much of the heat would be lost that what remained would not pay for the cost of getting it, at least until coal and other sources of power are much more expensive than they are now.



Move and Weigh at the Same Time

THE Merrick Weightometer enables you to weigh materials and record the results as they are carried along on the conveyor without the flow being interrupted or retarded.

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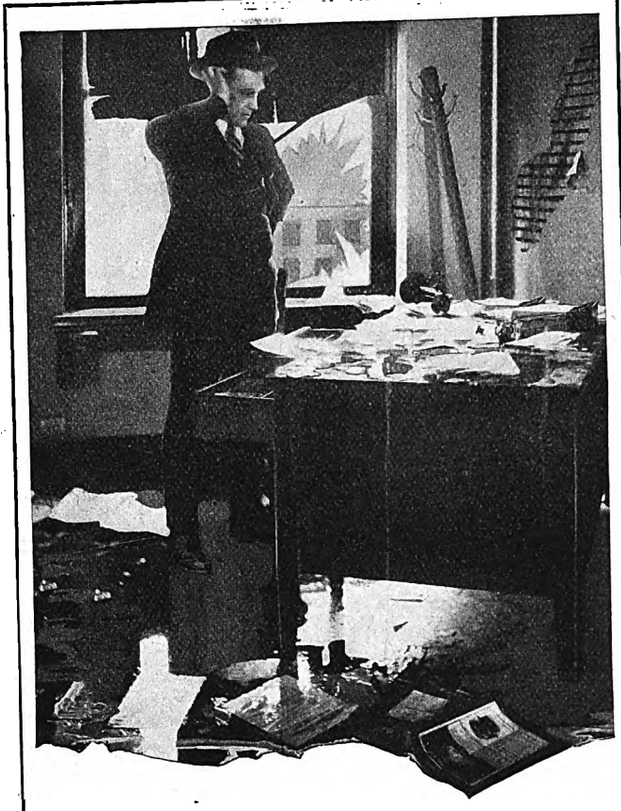
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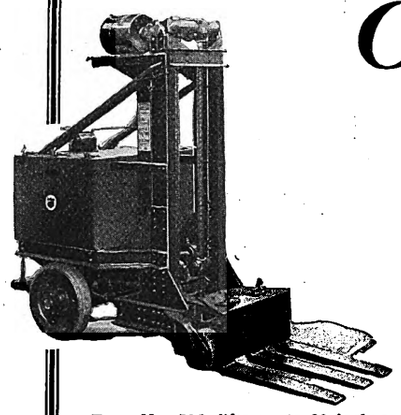
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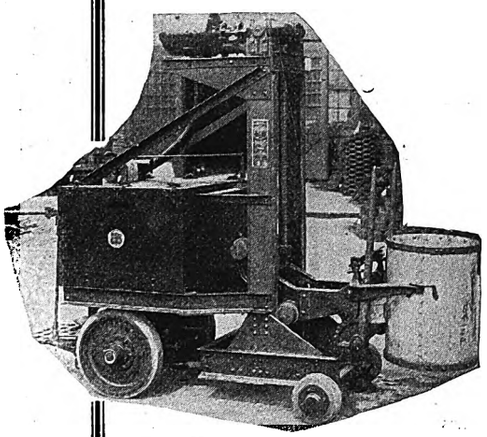
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The Tier-Lift Can Handle Anything



Type No. 706, lifts up to 80 inches, with fork attachment for carrying loads without using skids.



Type No. 706, with arm attachment for carrying loose material in standard containers.

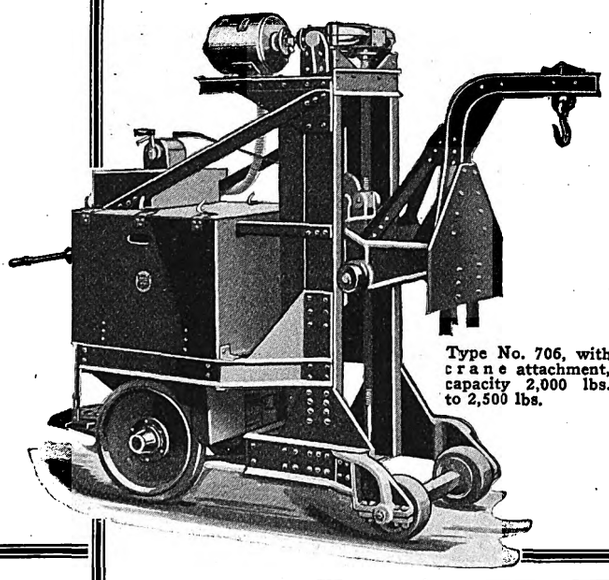
Bags, sheet metal, castings, bales, boxes or anything—The Lakewood Tier-Lift carries and lifts more quickly and at less cost.

Wherever used, Tier-Lifts save $2500.00 to $5000.00 per year—and they are used in nearly every industry.

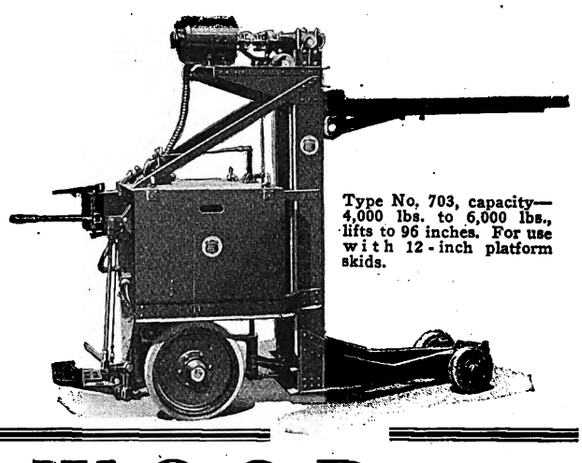
Look around you, on your next walk through *your* plant. Wherever you see a *man* moving a load, a Tier-Lift will do it for less.

Savings effected by Tier-Lifts may make a sizeable sum in a year. Let's estimate for you just what it might be.

No obligation—Drop us a line.



Type No. 706, with crane attachment, capacity 2,000 lbs. to 2,500 lbs.



Type No, 703, capacity—4,000 lbs. to 6,000 lbs., lifts to 96 inches. For use with 12-inch platform skids.

The LAKEWOOD ENGINEERING CO., CLEVELAND

Originators and Patentees of the Tier-Lift

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This



Cannot Happen With a Plimpton Lift Truck

Because

1—Built like an automobile, a Plimpton offers continuous four point load suspension. Thus load weight is equally distributed and there is no danger of tipping on turns.

2—The maximum breadth of truck top assures quick and safe handling of even the highest loads. The cupped platform tends to interlock the units of the load during transit.

3—A vertical lift in combination with aligning wheels and platform legs provides ample leg clearance with the least load elevation and lifting effort. The surrounding wheels and legs pass over an elevator sill together.

4—The Plimpton is practically a load length truck with all its wheels and mechanism compactly under the load, permitting its use in the smallest elevator.

5—Platform costs are materially reduced because the Plimpton truck top gives all round support and thus permits the use of lighter platform boards.

6—The Plimpton has right angle turn steering knuckles. Also a spring plunger mechanism in the tongue which automatically retains the handle in a vertical position when not in use. The oil operated release check with superimposed reservoir controls easy lowering of heaviest loads.

7—The angular shaped top with rounded corners facilitates entrance to platforms and saves rebacking.



In addition to these seven features, repairs on a Plimpton Lift Truck are practically nil, and everywhere the savings in trucking have been remarkable. In fact one manufacturer reports $60.00 per day saved in trucking costs—$21,600 per year.

Plimpton Lift Trucks have been in use over 10 years in American and Foreign government departments, railroads and internationally known firms throughout the world—sold on merit alone, without advertising. Our enlarged facilities now enable us to supply Lift Trucks for practically every conceivable plant or warehouse use.

Manufactured in 33 sizes.

Write for booklet describing the various sizes and industrial applications.

The Plimpton Lift Truck Corporation

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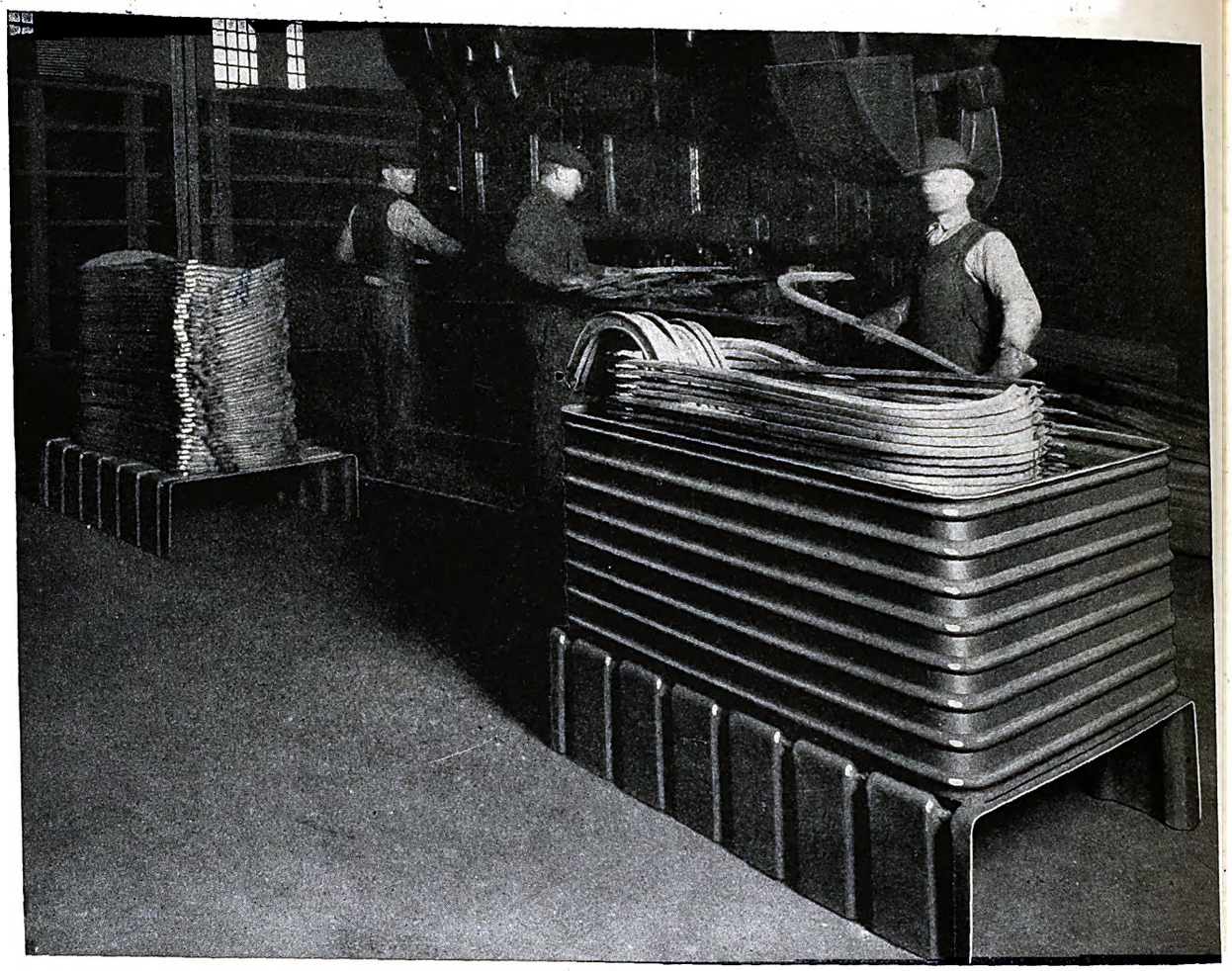
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In This Issue

What Is the Best Type of Roof?

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What Does Your Handling Curve Show?

Is your material handling curve running up or down? Does it show high costs for handling and rehandling?

The photograph above gives a graphic illustration of an efficient method of handling material. If such material were piled on the floor directly from machines, the time of at least two men would be necessary in the average plant in later rehandling this.

With Truscon Steel Platforms and Boxes handling costs are cut—less labor needed. Materials are placed directly from machines onto either the platforms or boxes. They are moved quickly and easily. Clear aisles and increased output are the results.

Truscon Platforms and Boxes are made from heavy steel, ribbed to hold white hot metal, and they will last for years under the hardest usage.

Let us give you additional facts on material handling for your particular business.

These nationally known firms are using an aggregate of more than twenty-five thousand (25,000) Truscon Alloy Steel Boxes and Platforms.

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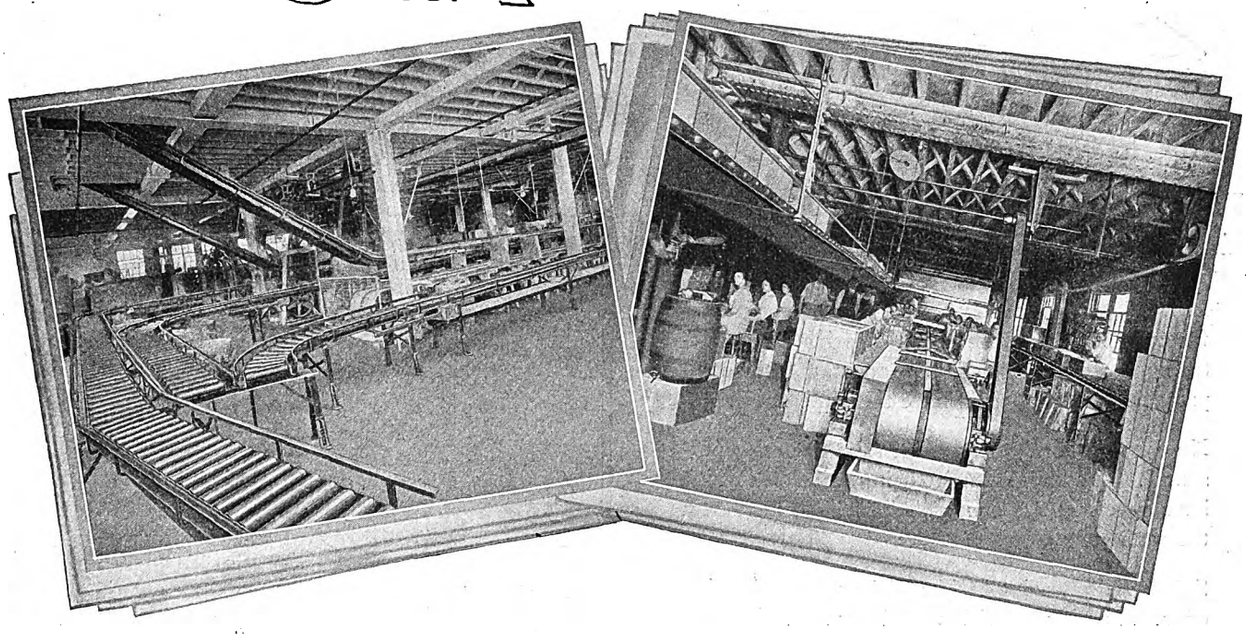
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ALLOY STEEL
PLATFORMS AND BOXES

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Van Camp's SINCE 1861 – *another user*





The photographs at the top show some of the Dow Gravity and Belt Conveyors which carry Van Camp's products through various plant operations and to packing and shipment.

THE profitable sale of any household commodity depends upon wide distribution. To effect wide distribution, volume production is necessary. Volume production is not possible without the most efficient, expeditious and economical methods of transporting materials and finished products through every phase of manufacture within the plant. The Van Camp Packing Company has chosen Dow Conveyors for this purpose. Hundreds of other nationally known manufacturers have done likewise. Does this suggest a possible saving of time, labor and money in *your* business? Ask our nearest office.

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LOUISVILLE, KY.

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An Old Company but a New Name

The trade-mark and the product haven't changed—only the company name is different

In the future Strom Ball Bearings will be manufactured by the Strom Ball Bearing Manufacturing Company. Thus the product, and the company that makes it, will have the same name.

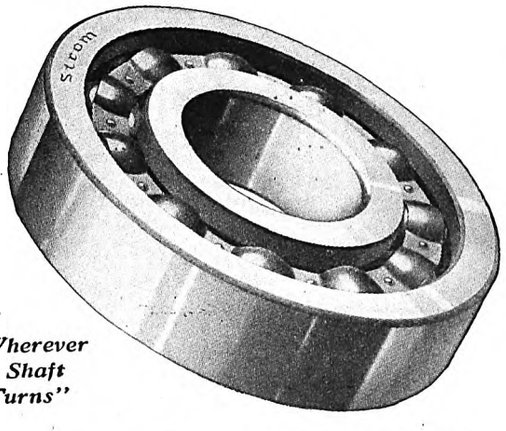
No changes have been made in the company personnel. The high manufacturing principles which have governed this concern's business will remain the same.

Strom Ball Bearings will still be made with that exact scientific precision and that devotion to perfection for which they have been noted in the past.

Our service will keep on improving, as it has improved in the past. And we ask for our company a continuation of the same kind and generous consideration which we have ever received from the trade.

Our engineers are here at your service. Consult them freely.

Our ample stocks are ready to meet any emergency calls. Strom Ball Bearings are made in a wide range of sizes and styles, ready to meet your requirements.



Used "Wherever a Shaft Turns"

STROM BALL BEARING MFG. CO.

(Formerly U. S. Ball Bearing Mfg. Co.)

4588 Palmer St. **Chicago, Ill.**

Industry Illustrated

The Pictorial Presentation of Practical Management

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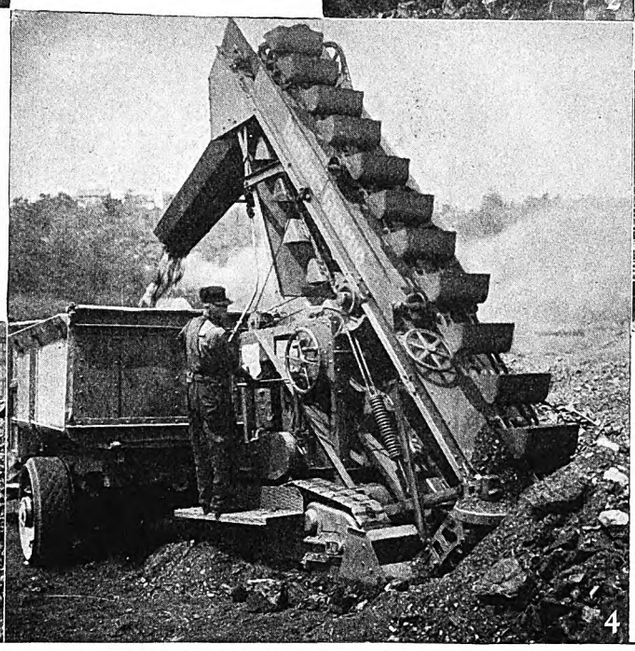


1—A Barber-Greene Conveyor and Loader at the Clinton Iron & Steel Co., handled 400 tons of ore in a day. They are doing work that men would not do.

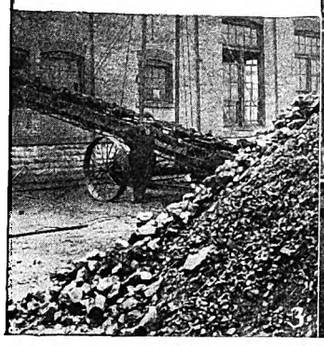


2—A Barber-Greene Conveyor, with cleated belt, handles lump coal at the J. S. Davis Coal Co., Toledo, Ohio, storing it well back from the tracks. It unloads a car of mine run in an hour.

3—Before the Miamisburg Light, Heat & Power Co. bought this Barber-Greene, there was demurrage on one or two cars out of every three received. There has been no demurrage since.







4—Replacing a steam shovel with a Barber-Greene Bucket Loader, for loading coal and cinders at the Pennsylvania Edison Company. It loaded 109 tons in four hours, with only two trucks running over a two-mile haul.

5—Barber-Greenes at work in the Hunt-Spiller yards in Boston. They unloaded an 800-ton barge of molding sand in 2½ days.

Replacing a steam shovel at handling coal and cinders

Replacing a steam shovel at handling cinders and mine run at the Pennsylvania Edison Company, a Barber-Greene Loader handled 4½ tons in three minutes.

Two trucks were used over a 2-mile haul. But in spite of the long waits between loads, the Barber-Greene loaded 109 tons in four hours.

At the Clinton Iron & Steel Company in Pittsburgh, a Barber-Greene Conveyor and Loader handled 400 tons of ore in a day.

As the ore weighs 150 pounds a cubic foot, men would not shovel it. Now, with four men, the Barber-Greenes load 1500 pounds in fifty seconds.

At the Hunt-Spiller Company in Boston, the arrival of a sand barge always brought a serious unloading problem. Three Barber-Greenes now unload an 800-ton barge in 2½ days.

Working the year round, each conveyor has replaced nine men at storing and reclaiming. Eight tons of molding sand were handled in ten minutes, and 400 tons in a day.

If the rapid handling of materials is a problem that has not been economically and completely solved at your plant, you will find many valuable suggestions in our Catalog E. Send for it today.

Barber-Greene Company, 500 W. Park Ave., Aurora, Illinois

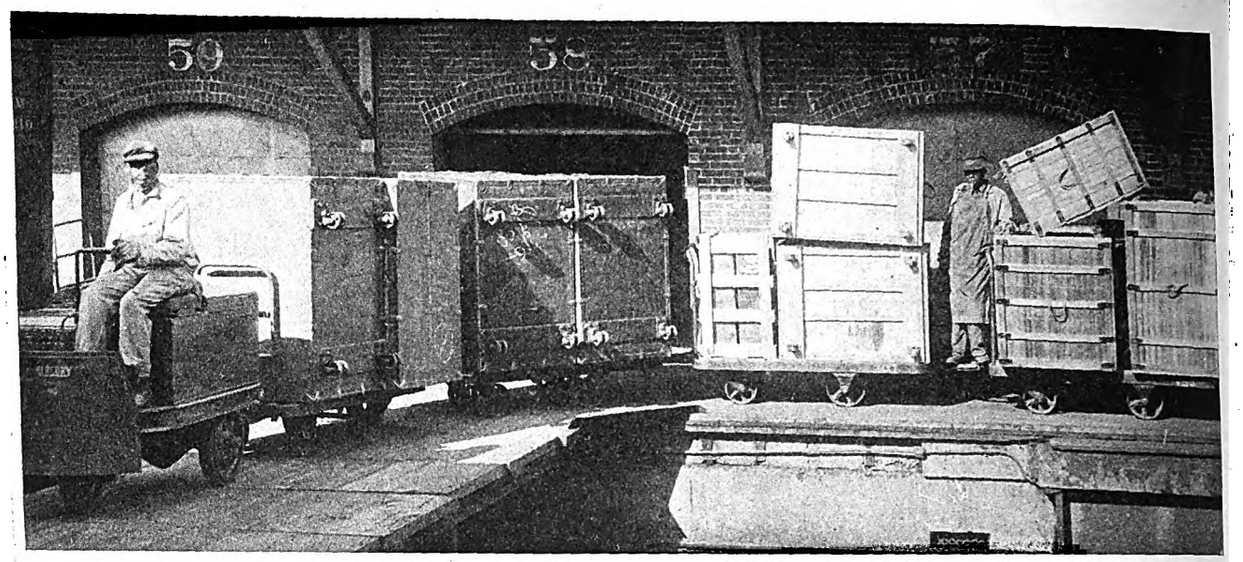
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Portable Belt Conveyors — Self Feeding Bucket Loaders

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A few of the 350 Hyatt equipped trailers, type A-310, built by the Mercury Manufacturing Company, Chicago, Ill., in operation at the freight house of the Louisville & Nashville Railway at Birmingham, Ala. Other large installations of these trailers are as follows:

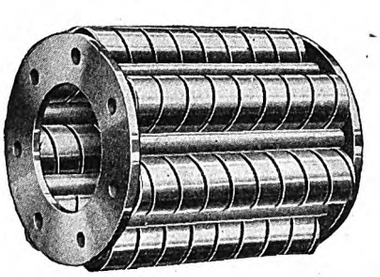
Pennsylvania Railway, Detroit, Mich.	150 trailers
Chicago, Burlington & Quincy Railroad, St. Joseph, Mo.	75 trailers
Chicago, Burlington & Quincy Railroad, Chicago, Ill.	200 trailers
Chesapeake & Ohio Railroad, Charleston, W. Va.	200 trailers
Baltimore & Ohio Railroad, Columbus, O.	150 trailers
Southern Pacific Railroad, San Francisco, Cal.	100 trailers

Hyatt Roller Bearings on Mercury Trailers

Realizing that easy turning wheels with bearing dependability and durability are the basis of satisfactory trailer performance, the Mercury Manufacturing Company equips its standard A-310 trailers with Hyatt bearings exclusively.

Whether these trailers are pushed by hand or hauled in trains, the Hyatt bearings enable them to carry heavier loads in less time.

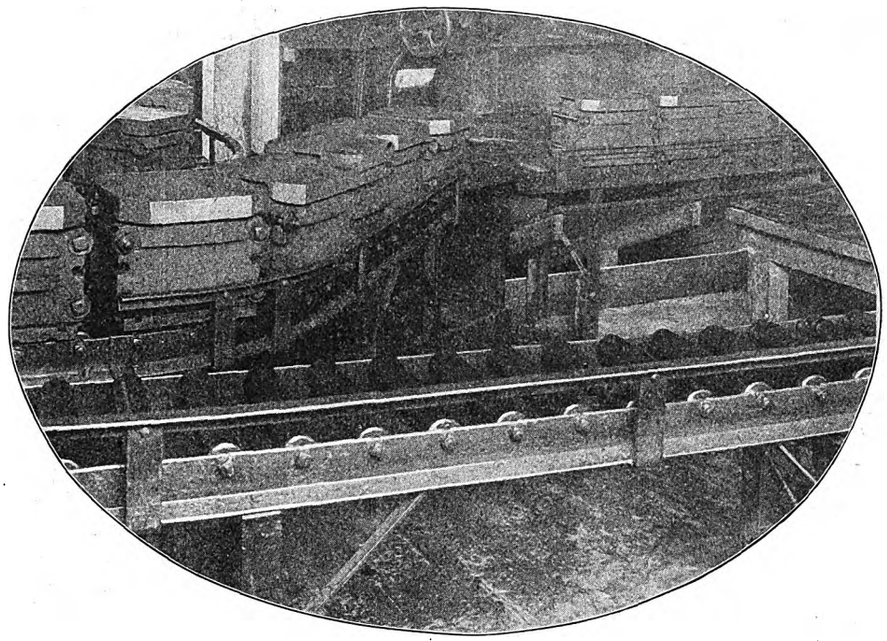
More freight moved per truck, per man and per hour is the platform on which Hyatt bearing equipment bases its claim of superiority.



HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER MILWAUKEE HUNTINGTON MINNEAPOLIS PHILADELPHIA
CLEVELAND PITTSBURGH BUFFALO INDIANAPOLIS

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Where $2266.57 Brings Back $7200.00 in One Year

The Rub Tex Company of Indianapolis manufacture battery cases.

The molds in which they are poured weigh from 150 to 600 lbs. each.

The volume handled averages 384 tons daily.

Standard Gravity Roller Conveyors handle this product.

They save in labor expense $7200.00 a year.

The conveying equipment cost $2266.57—and buys itself three times a year.

The figures given here are a lesson in economical handling. They also point to durable, dependable construction of the conveyor.

In Booklet S-5 you will find some very interesting applications of Standard Conveyors. We will be pleased to send it to you.

STANDARD CONVEYOR CO.

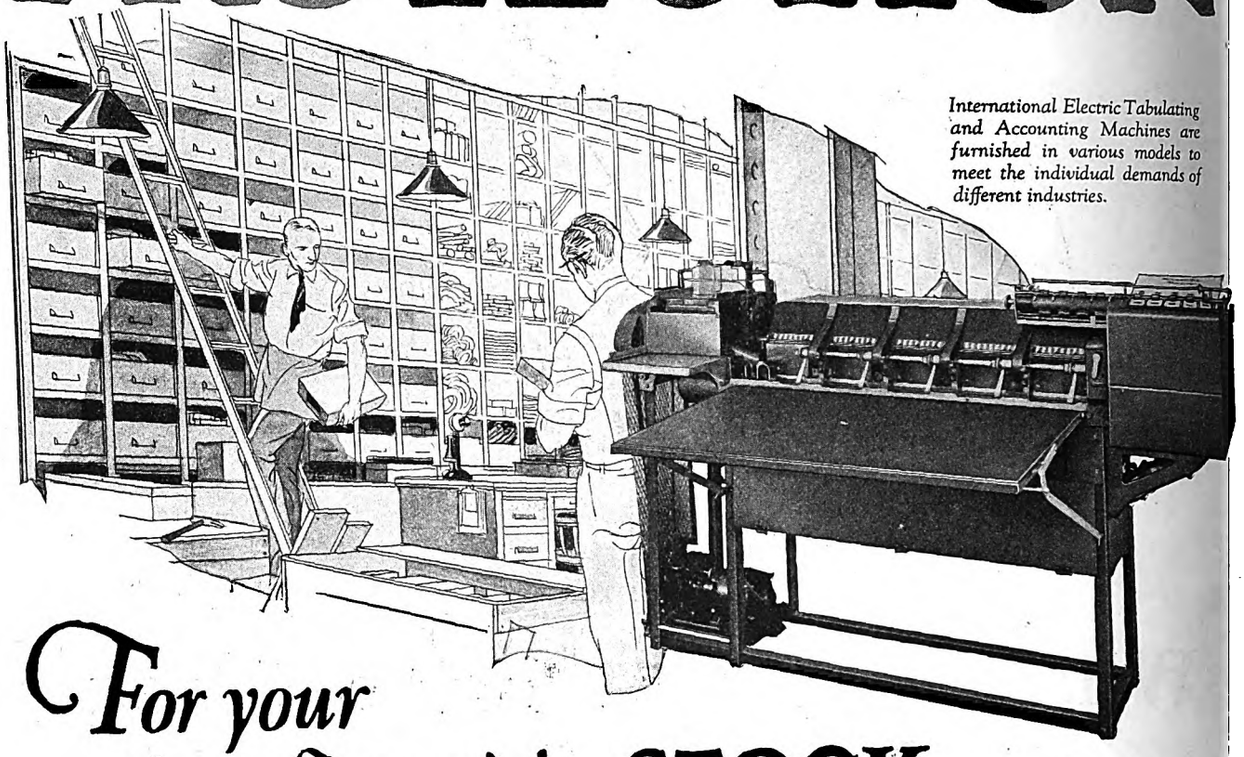
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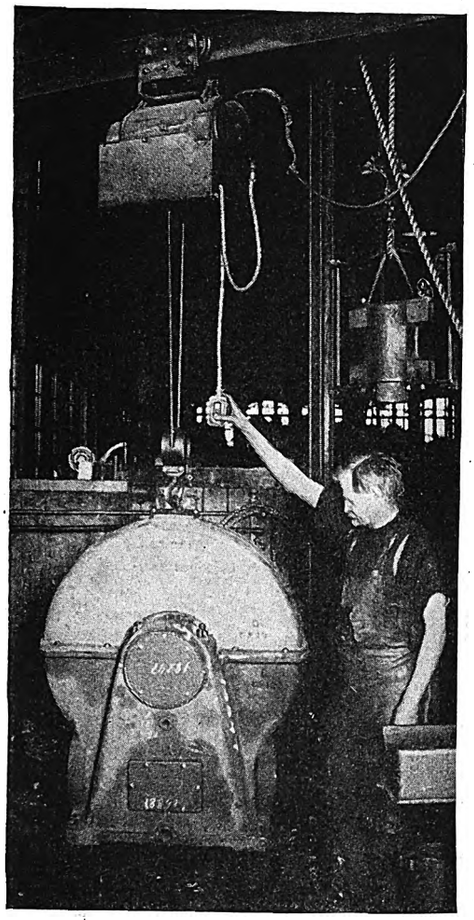
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General Electric Type I-6 Sprague Hoist with standard push button control, lifting heavy gear case at A. B. See Electric Elevator Company, Jersey City, N. J. This hoist is equipped throughout with Hyatt roller bearings.

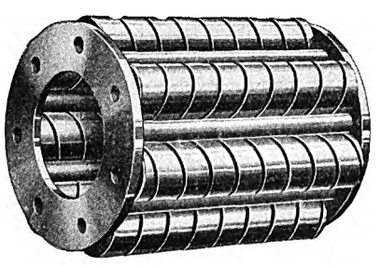
General Electric Company Standardizes on Hyatt Bearings For Its I-6 Sprague Hoists

The General Electric Company, anticipating the sort of exacting service required by the A. B. See Electric Elevator Company, equips these heavy duty hoists with Hyatt roller bearings throughout.

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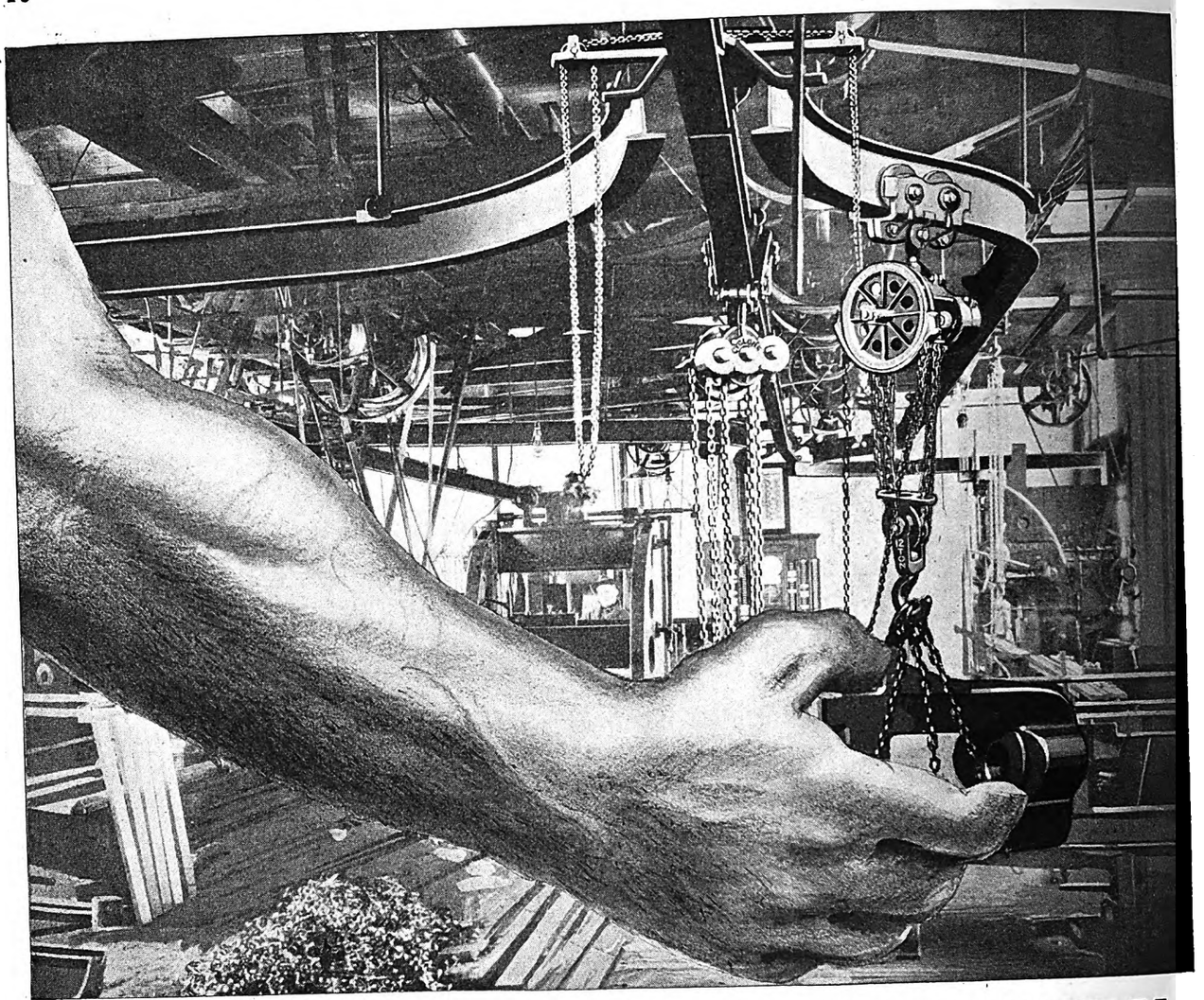
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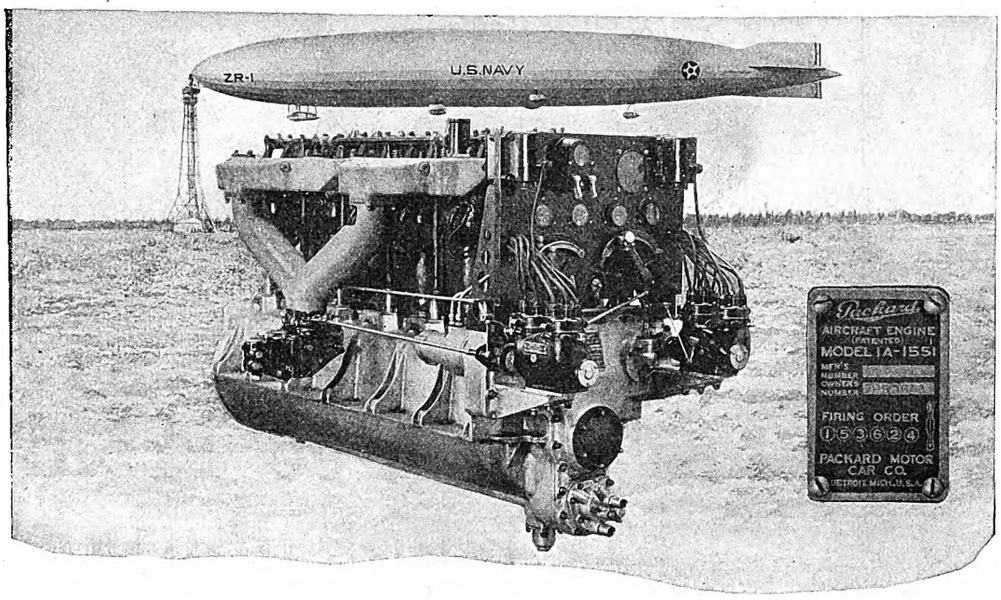
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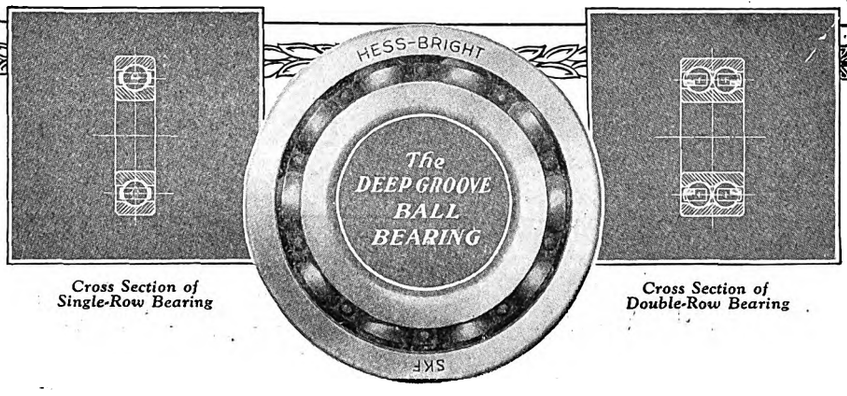
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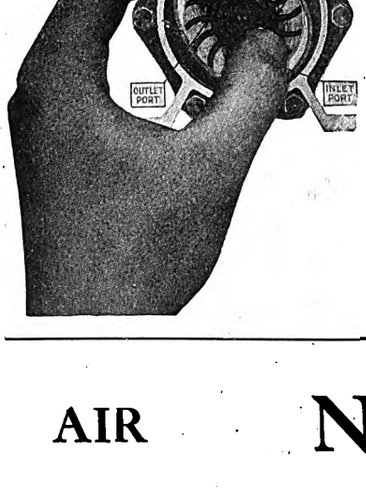
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Editorial

The New Emancipation

ON the 16th of May, 1792, King Christian VII of Denmark issued a royal order to the effect that the slave trade should be abolished in all Danish possessions from the end of the year 1802. This was the first link in a chain of events which culminated in the immortal Emancipation Proclamation of Abraham Lincoln, seventy-one years later.

In all the hundreds of years of recorded history previous to that time, human slavery was not only a part of the structure of civilization; it was a necessary part, without which the whole structure could not have been maintained.

It is but a brief handful of years—not quite sixty years, to be exact—since the Constitution of our country was amended to abolish and forever prohibit human slavery in the United States. There may still be an individual, here and there, who would like to see a return to that time-honored institution; but not even these few reactionary ones could bring forward any solid economic reason for their choice. And why?

Many men, in all ages—even back in ancient days—saw the evils and deplored the results of slavery. Men had begun to see more clearly, even before Denmark led the way. For taking the first step, all honor to that country and its statesmanship; for resolutely facing and clarifying and meeting the issue, all honor to our martyred Lincoln. But for *making possible* these great steps which removed a blot from civilization, the credit belongs elsewhere.

Until Watt, by his genius, converted an inefficient pump into a mechanism for converting steam into power, civilization could not have maintained itself without some form of slavery. Until other geniuses had carried on Watt's work—improved upon it, applied it to those tasks which had to be done, and which hitherto had been possible only through manpower—however much enlightened men might deplore that serfdom, they *could* not abolish it.

For thousands of years philosophers, statesmen, economists with all their best thought were unable to lift the yoke. And in a brief space of a little more than a century, mechanical genius has not only lifted that yoke, but has shown the way to an ever higher standard of civilization.

It is machinery, through applied mechanical genius—that holds the secret of low-cost production. And large scale production at low cost, this—and not any scheme or theory of government—is the key to the emancipation of the great mass of humanity.

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What Is the Best Type of Roof?

Factors of Major Importance in Industrial Roof Construction

By Walter F. Ballinger

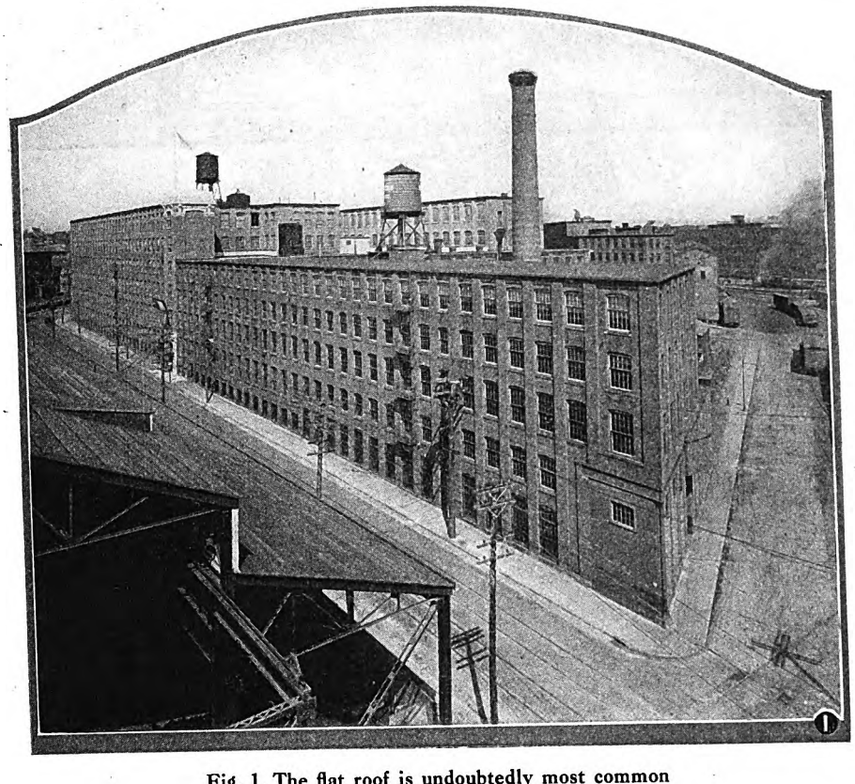
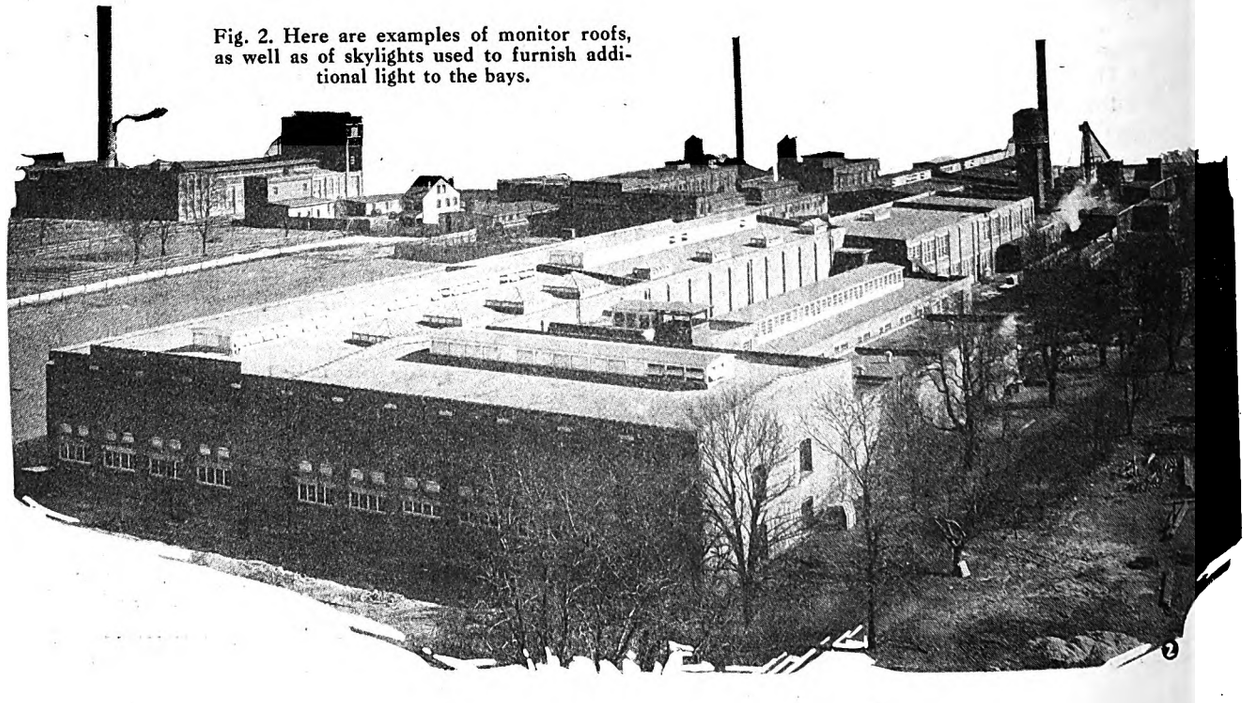


Fig. 1. The flat roof is undoubtedly most common in existing buildings because it is the simplest to build.

ROOFS for industrial buildings, often regarded as a necessary evil and often neglected both during design and later in maintenance, deserve a great deal of attention. In the design of a building of several stories, it is possible to carry out certain ideas with the roof structure that could not be accomplished with the lower floors. By eliminating columns, we can have wide spans, thus getting good natural ventilation, and with the proper kind of roof, large quantities of light uniformly distributed through skylights. Each style of roof is of course best suited to particular situations and special purposes and has its own peculiar advantages. Furthermore, if we take into consideration the foundation, the floors, the walls and the roof of a building, the most important of these is evidently the roof.

The best type of surface for a roof has an important bearing on the maintenance cost of the whole building. And right here attempts to save money by skimping the initial outlay on the roof will surely lead to large expenditures to maintain it as time goes on. Careful consideration

Fig. 2. Here are examples of monitor roofs, as well as of skylights used to furnish additional light to the bays.



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should be given to the type of roof to be put on an industrial building. Sometimes the cheapest roof to construct is hastily decided upon through neglect to consider the advantages offered by other types which, though costing more, would add considerable value to the finished building.

A flat or nearly flat roof carried by beams, girders and columns is the simplest type and one that is commonly used for industrial buildings because where the presence of columns in the working spaces is not an objectionable feature, it is about the cheapest to build and keep tight. It is usually built of wood or steel; sometimes of both these materials and gypsum or reinforced concrete are also used in many instances. Columns, sometimes closely spaced, must be used for support. In this connection, too, it may be stated that the only advantage for the top floor of a factory, as compared with the lower floors is that skylights and monitors may be put in the roof over it.

In many buildings it is essential to gain wider spaces between the columns supporting the roof and even to avoid using columns wherever possible. With this end in view, architects employ a truss, usually one or the other of two styles. One of these, the "A" type, gives to the roof a distinct pitch in two directions; the other, known as the "Howe" truss, makes a somewhat flat roof. The sawtooth roof, a comparatively new type, providing long spans without columns, will be mentioned later. All three have characteristic advantages

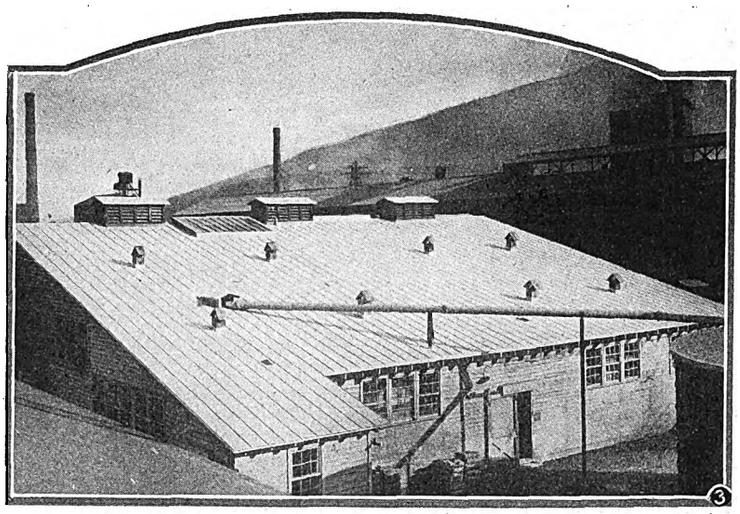


Fig. 3. Here is a standing seam zinc roof—a roofing frequently used for industrial buildings because of its weather-proof, non-rusting qualities.

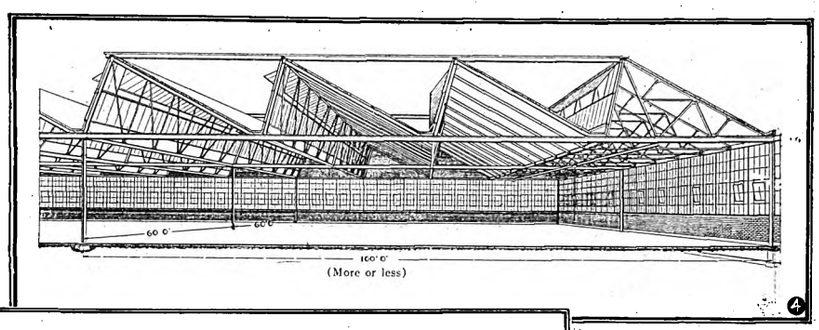


Fig. 4. This is how the "Super-Span" sawtooth roof construction eliminates columns on long spans.

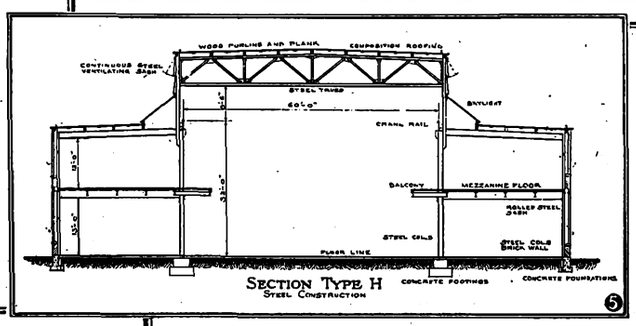


Fig. 5. Details of a type of monitor in common use for factory structures.

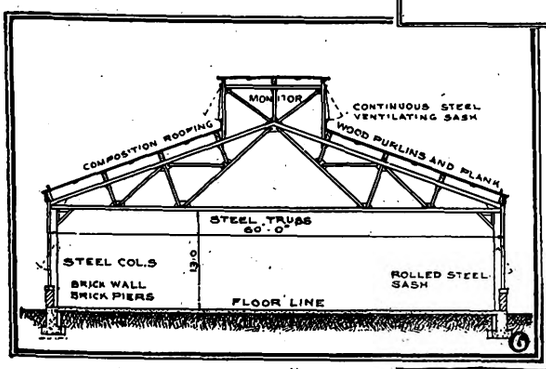
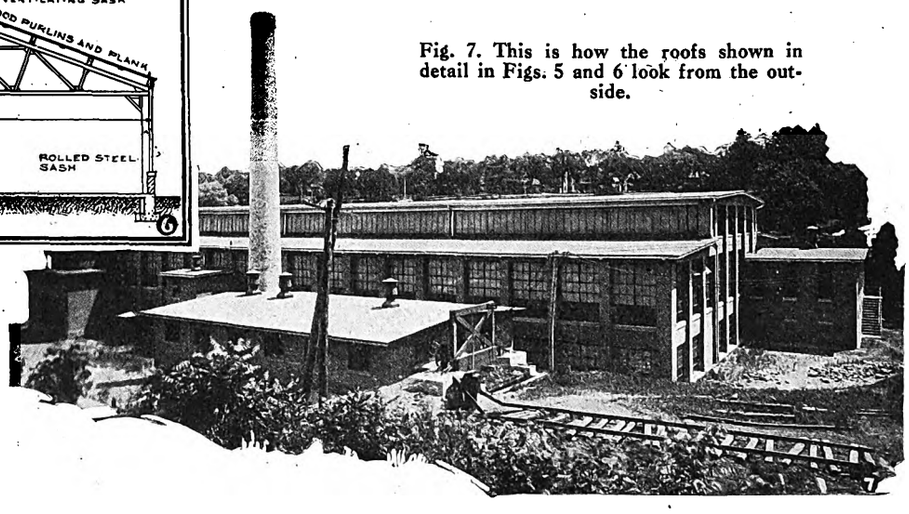


Fig. 6. In this type of monitor construction there is no need for vertical columns.

Fig. 7. This is how the roofs shown in detail in Figs. 5 and 6 look from the outside.



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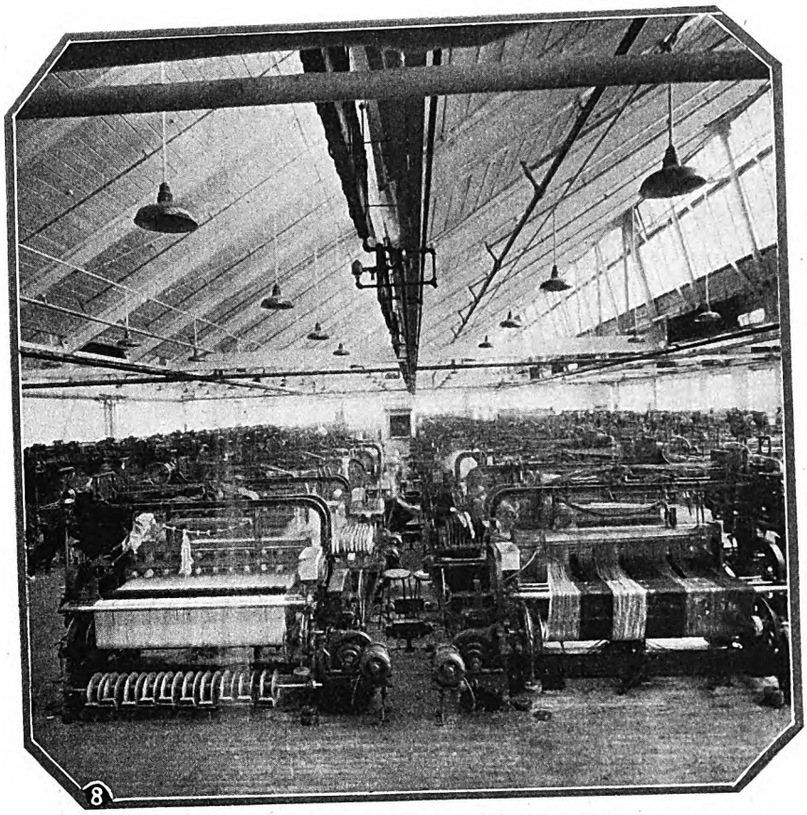


Fig. 8. Inside a sawtooth roofed building, showing how even is the illumination; the wall at the left, incidentally, is a solid brick wall.

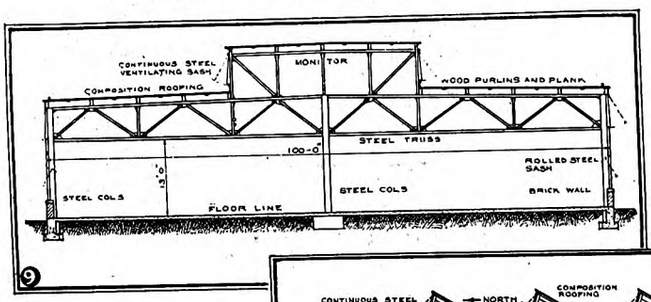


Fig. 9. For wide spans, it is common practice to use columns. These can be centered, as shown above.

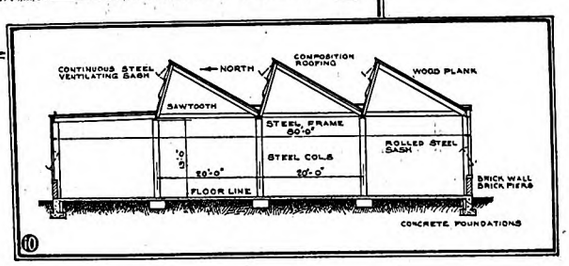


Fig. 10. The ordinary sawtooth roof requires vertical columns. Contrast this with Fig. 4.

best suited to particular conditions.

Considering the first mentioned, the "A" style truss roof, owing to its steep slope warm air and obnoxious fumes are readily disposed of as they easily move up towards the ridge from which they may pass out through monitors or ventilators built into the roof for that purpose. So they provide good natural ventilation if the escaping gases and fumes are lighter than air. For spans up to sixty feet and sometimes slightly more, the "A" truss roof is commonly employed. Surmounted by a monitor of some kind on the ridge for the purpose of light and ventilation, it is best suited for detached or individual buildings. Otherwise, if two or more such roofs were placed close together on the same building there would be deep valleys between, which would be objectionable on account of accumulation of snow as well as for other reasons.

In building a roof of this kind it is sometimes necessary to avoid the presence of any obstructions to the easy movement of ascending air currents, especially if the latter contain much moisture. Thus a purlin, if put in horizontally, will form a sort of pocket with the roof planks, which will surely obstruct the rising currents of moist air. The air thus caught would be likely to deposit its moisture by remaining in contact with the under side of the comparatively cool roof, and this condensation

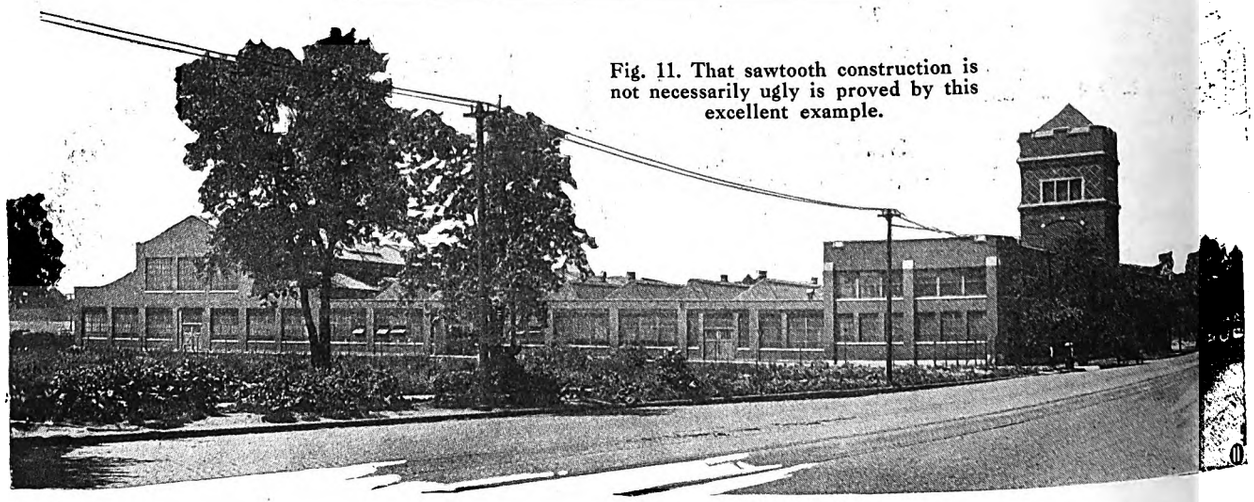


Fig. 11. That sawtooth construction is not necessarily ugly is proved by this excellent example.

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would drip down on anything below. Not only that, but the air, having cooled off, would then drop gradually out of the pocket and more warm, moist air would take its place. The repetition of this action can be prevented by construction that will allow the continuous rapid movement of the air to the outside atmosphere.

To avoid the valleys formed by "A" type trusses placed together, a flat or "Howe" truss may be used. For spans up to approximately eighty feet, some form of Howe truss is generally employed. Longer spans may be put in, provided the added cost is considered worth while. Flat trusses are adapted for roofs over very wide buildings if columns are put in and monitors and skylights built on the top to give the necessary illumination. The height of a Howe truss is about one-eighth of the span; thus an eighty-foot span would require a truss nearly ten feet high. For that matter, all flat trusses impose an additional height to the building at the eaves so as to get the truss above the clearance allowed for the lower chord.

This increases the cost of the building as well as the cost of heating an additional quantity of air, and in some cases for conditioning it.

There are many forms of monitors and they are used on flat roofs and pitched roofs indiscriminately. The usual monitor is built with two parallel, vertical rows of glass on each side of the ridge with a flat or pitched roof over them, according to the style of roof over which they are placed. Sometimes a monitor roof is built inverted to form a V-shape, the roof surfaces having a slope downward to the center, in order to facilitate ventilation by doing away with a pocket at the ridge. The windows are then located at the highest point of the monitor. Flat roofs are occasionally built pitched so as to drain in one direction and pro-

(*Continued on page* 75)

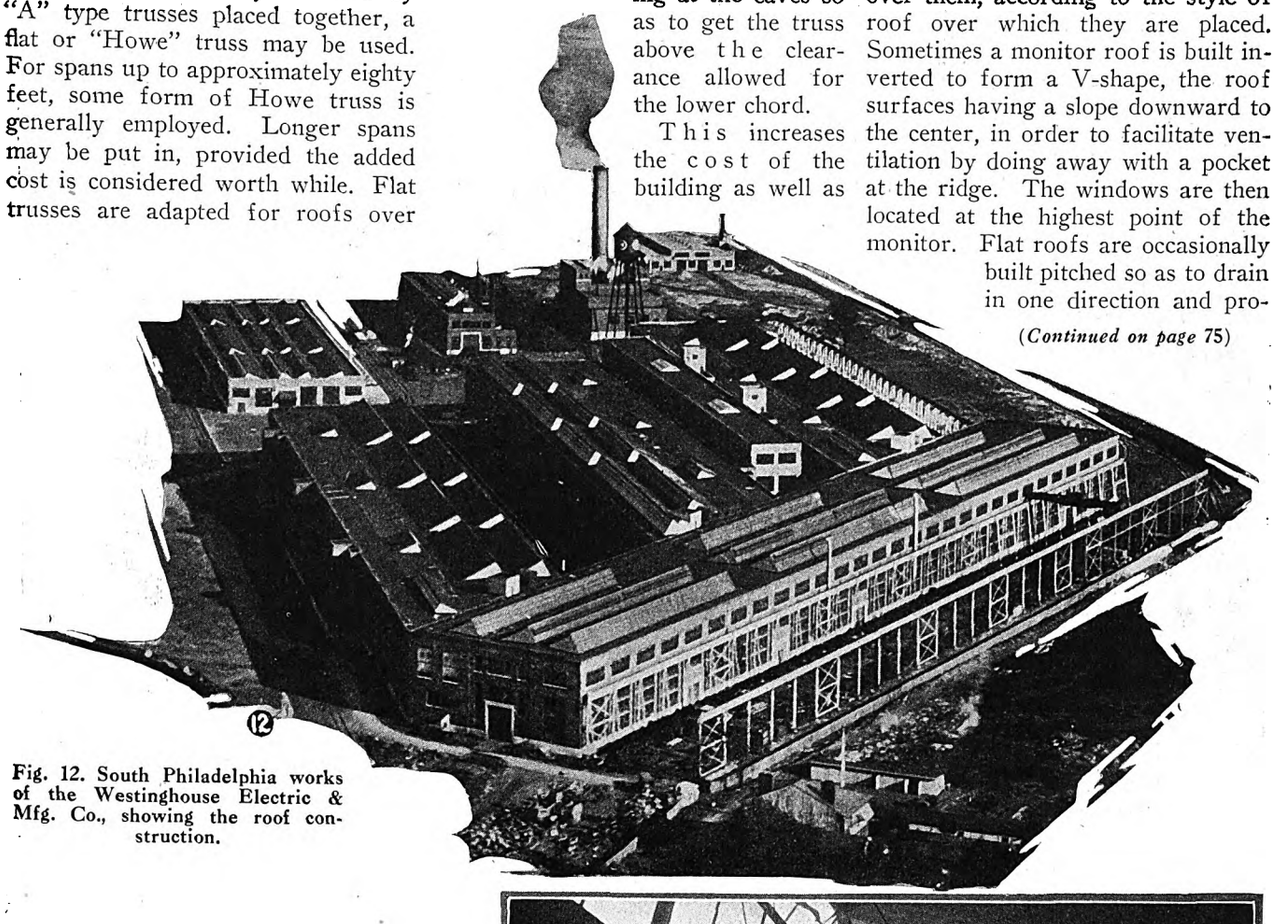


Fig. 12. South Philadelphia works of the Westinghouse Electric & Mfg. Co., showing the roof construction.

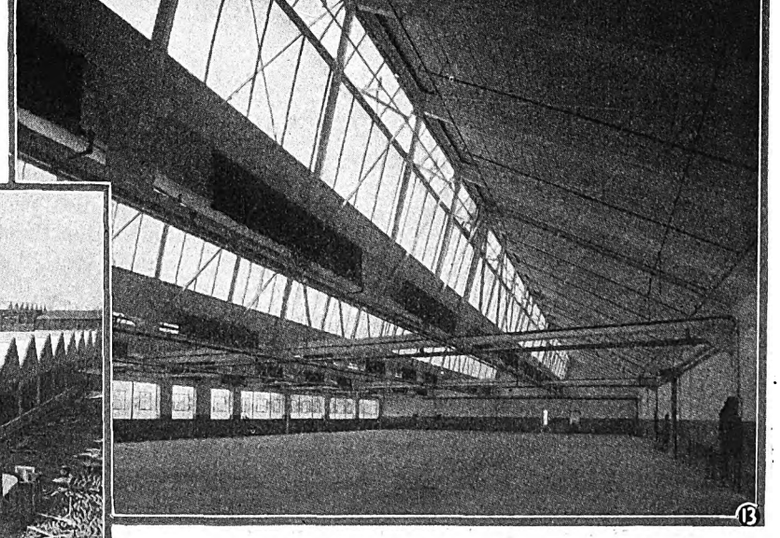
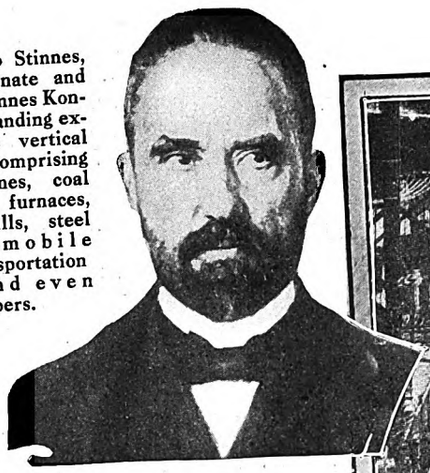


Fig. 13. Above—Inside the "Super-Span" sawtooth structure, showing the unbroken floor area and splendid natural light.

Fig. 14. Below—White surfaced roofing material on this sawtooth roof reflects the light into the building.



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The late Hugo Stinnes, industrial magnate and head of the Stinnes Konzern—an outstanding example of the vertical combination, comprising iron ore mines, coal mines, blast furnaces, rolling mills, steel plants, automobile plants, transportation companies, and even newspapers.

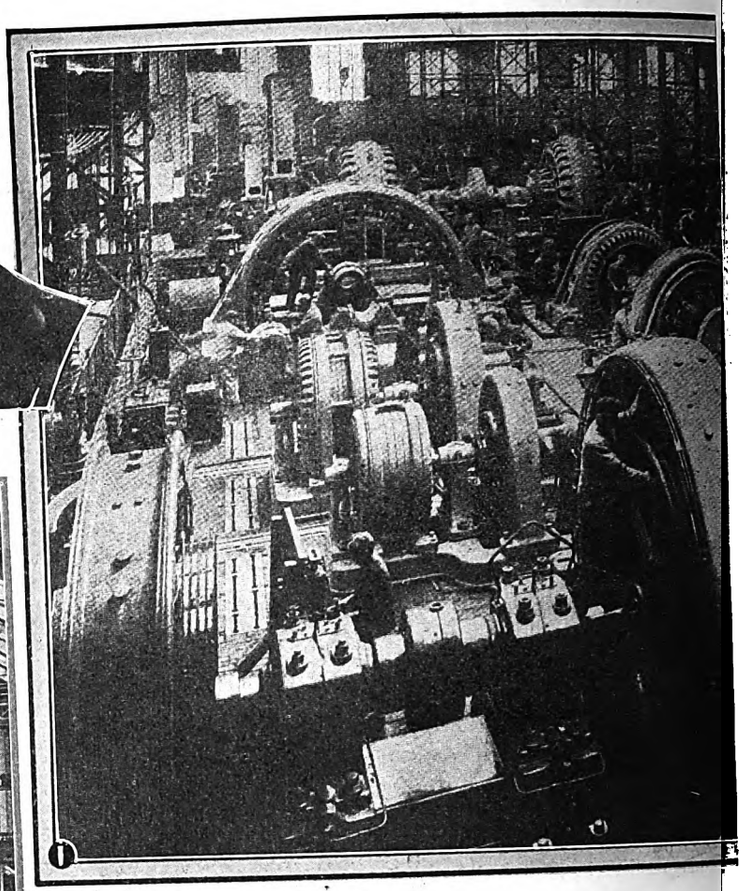


Fig. 1. One of the large machine plants of the A. E. G. (Allgemeine Elektricitäts Gesellschaft), of Ger-

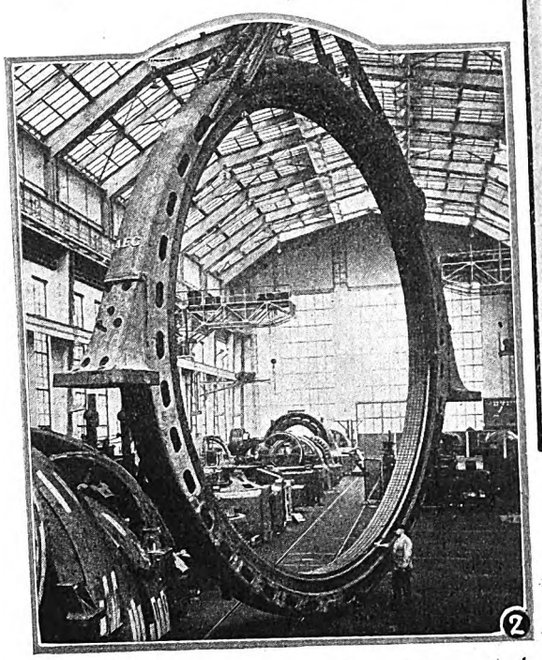


Fig. 2. Part of a huge generator under construction at one of the A. E. G. plants.

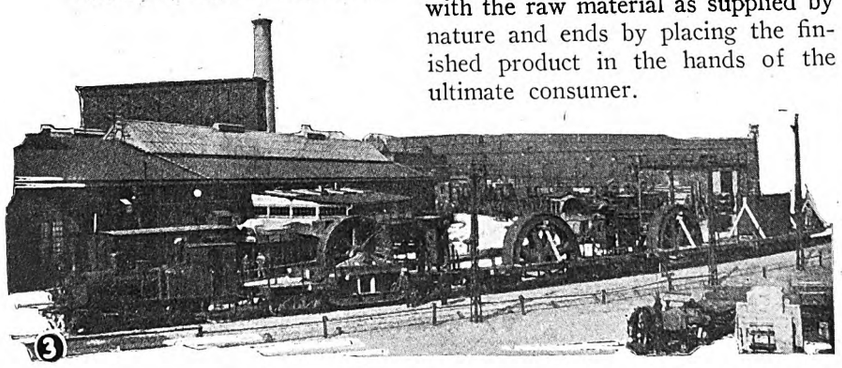
Meeting Competition in Vertical Combination

How the "Vertical Trust" Came About

By Dwight T.

THE vertical trust is a consolidation of a number of industries of such a sort and in such a manner that the finished product of one is the raw material of the next. The complete vertical trust begins with the raw material as supplied by nature and ends by placing the finished product in the hands of the ultimate consumer.

Fig. 3. There is a striking similarity in this shipment from an A. E. G. plant to some of our views of the Schenectady plant shown elsewhere in this issue.

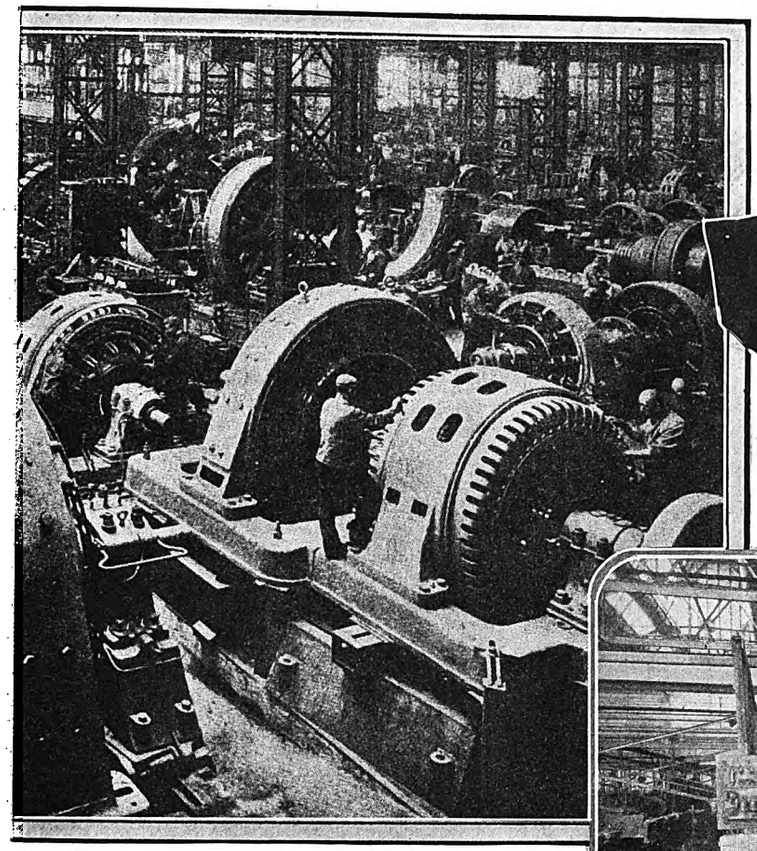


The name vertical trust arose as a means of differentiation from the horizontal trust and the consolidation of allied industries which are the common forms of industrial consolidation in America. The horizontal trust is a consolidation of industries manufacturing a single product—as matches or automobiles. The consolidation of allied industries combines plants manufacturing articles of a similar nature, or which can be sold to the same market—as computing and tabulating machines and time clocks, or radiators and boilers.

As nearly as I have been able to determine, the first vertical trust was conceived by Andrew Carnegie. Charles R. Flint, who is rightly called

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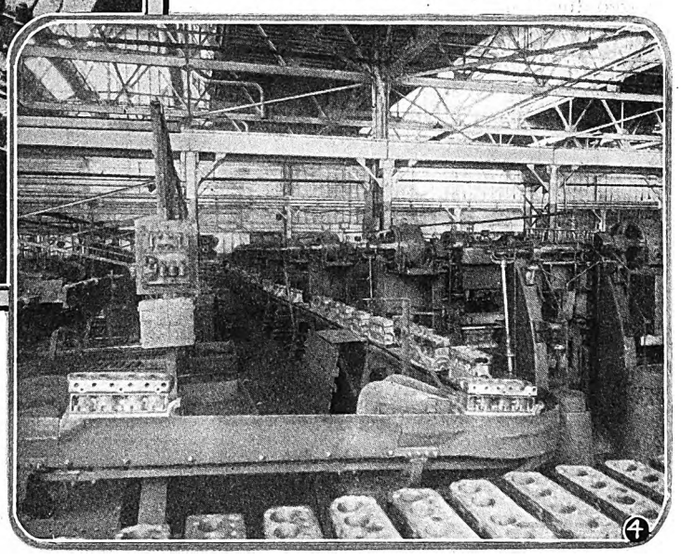
many; which is nearly as large as the Stinnes Konzern, but concerns itself with electrical products chiefly.





Henry Ford, whose company is one of the largest examples in this country of the tendency toward vertical combination. Starting as an automobile factory, this company has spread along the straight-line path forward toward the ultimate buyer, and back toward transportation and raw materials.

Fig. 4. The "moving production" idea, so highly developed by Ford, is being carried outside the factory to maintain a steady flow from mines to market.



ition by Ver-bination

Operates—and Why

Farnham

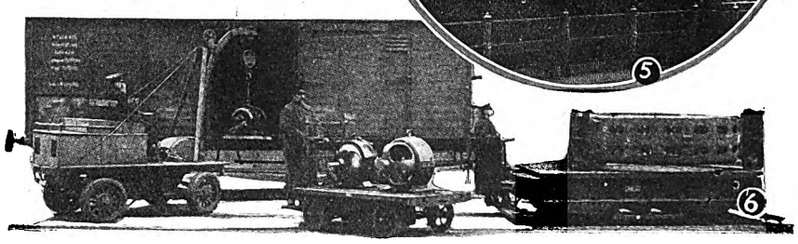
the Father of Trusts, having personally formed some twenty-one industrial consolidations told me the story at his Long Island country place in 1923*.

Carnegie had learned the vital lesson of the necessity for owning raw materials and finishing the completed article ready for its purpose. At this time he had Virginia ore mines and ironstone mines in Pennsylvania. He had purchased half of the Frick Coke Company which owned expensive mines of the best coking coal. He had built blast furnaces and he owned the Edgar Thompson Works which produced steel rails, the Homestead

Fig. 5. Large consolidations, such as the A. E. G., permit of the fullest use of labor saving equipment.



Fig. 6. Even though labor is far cheaper in Germany than here, yet the big plants realize what modern equipment means in materials handling.



*Note—See also Memories of an Active Life by Chas. R. Flint. (Putnams).

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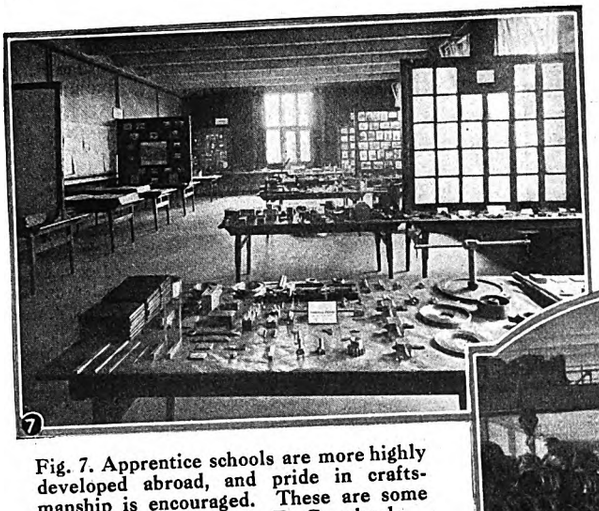


Fig. 7. Apprentice schools are more highly developed abroad, and pride in craftsmanship is encouraged. These are some products from the A. E. G. schools.

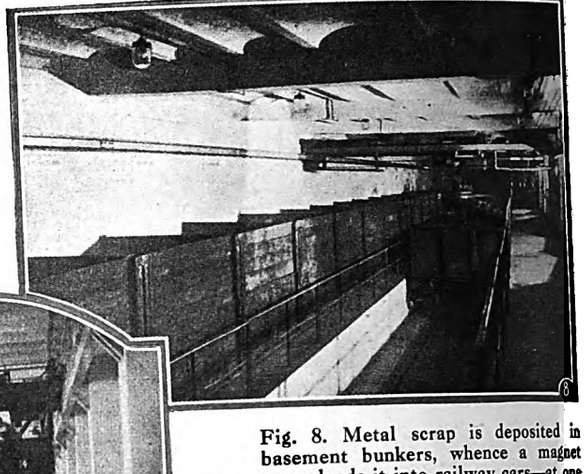


Fig. 8. Metal scrap is deposited in basement bunkers, whence a magnet crane loads it into railway cars—at one of the A. E. G. plants.

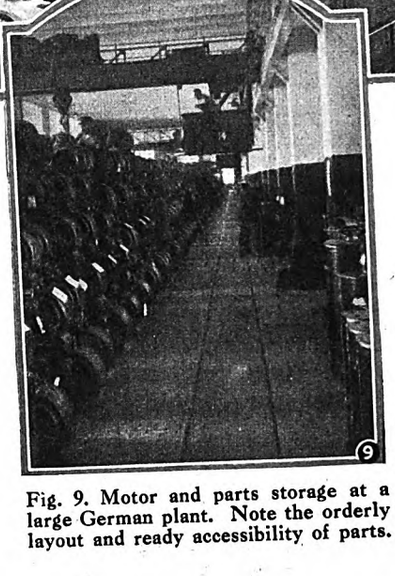


Fig. 9. Motor and parts storage at a large German plant. Note the orderly layout and ready accessibility of parts.

Mills which manufactured miscellaneous steel shapes and he had purchased the Hartman Steel Company to work into various products the output of Homestead. In 1897 he was mining coal from some 42,000 acres of coal land, was turning out 18,000 tons of coke per day, 2,000,000 tons of pig iron per year and 6,000 tons of iron and steel per day.

When negotiations for the formation of the Steel Trust began a little later, those most active, knowing that Mr. Flint had been a colleague of Andrew Carnegie in the First International American Conference and had visited him in Scotland asked him to call on Carnegie and to ascertain if possible Carnegie's attitude toward the proposed consolidation.

Mr. Flint found Carnegie in his library where he talked very freely. He brought out blueprints and described his plants and his future plans in great detail. He showed how with such a vertical consolidation of mines, furnaces, plants and transportation facilities he could manufacture tubes more cheaply than the National Tube Co., structural steel more cheaply than the American Bridge Co., and wire at a lower cost than the American Steel & Wire Co. He discussed each section of steel manufacture at length and showed in detail how impossible it would be for existing corporations to compete with such a vertical consolidation. Finally he told Mr. Flint that he need not consider this information confidential.

In view of the fact that such a vertical trust would be invincible and that Carnegie was the one man in the United States who could make it effective, Mr. Flint's friends decided that the Carnegie plants must be acquired. The final result was the organization of the United States Steel Corporation.

In 1920 I found well de-

(*Continued on page 38*)

Fig. 10. Huge yard cranes over the railroad sidings at a modern German plant.

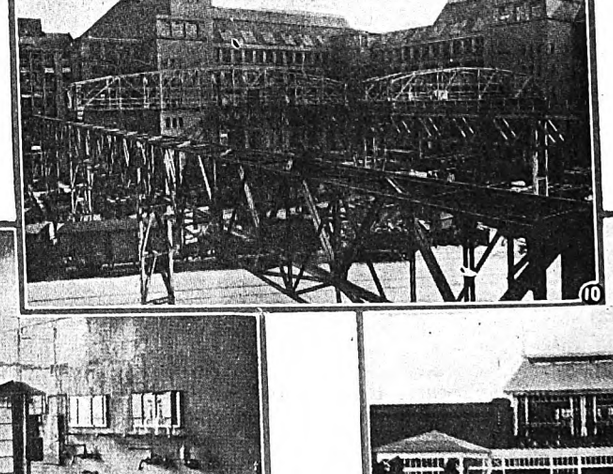




Fig. 11. Hospital facilities are a part of every modern plant, and this phase of modern management is well taken care of in the A. E. G.



Fig. 12. Roof garden on top of one of the A. E. G. plants. Employee welfare is not lost sight of by these organizations.

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Keeping the Gear Teeth Quiet

By Allen F. Brewer

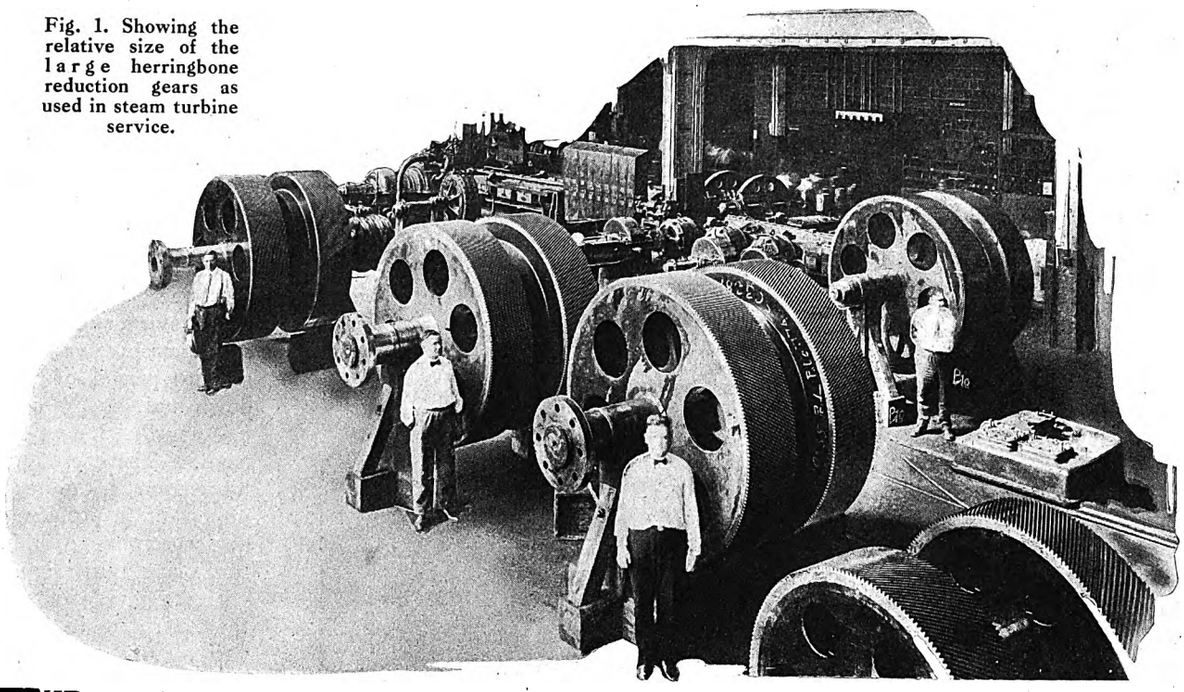


Fig. 1. Showing the relative size of the large herringbone reduction gears as used in steam turbine service.

THE next time you pass a set of gears which greets you with a vibrant clatter and clash as though they were endeavoring to simulate a blacksmith shop, pause a moment and consider the reason for this. Don't merely breathe a few complimentary (?) adjectives because perhaps your conversation has been interrupted. This won't cure a set of noisy gears,—one of the most objectionable and inefficient conditions that can be encountered in the modern industrial plant. Rather, tip off the engineer that a little of the right kind of lubrication is what his gears are gnashing their teeth about.

Lubrication, in fact, is the secret of efficient gear operation just as it is the keynote of mechanical efficiency everywhere else in the plant. The modern gear is a scientifically designed, carefully constructed mechanism, so accurate in shape as to mesh perfectly with its companion gear. Friction, however, cannot be eliminated with all our scientific efforts. Between all gears there must occur a certain amount of sliding and rolling friction as corresponding teeth engage or mesh. In proportion to the care exercised in their design and construction, the former will be reduced, though it can never be eliminated entirely. Pure rolling friction is in fact, a scientific ideal that is rarely attained in practice.

So we take the next best course and introduce a fluid or semi-fluid lubricant between the teeth as a partial solution to our problem. A further purpose which this lubricant serves is to eliminate noise. In fact noise is the harbinger of wear in gear operation, for it indicates imperfect meshing. The consequent repeated impacts resulting from this latter are the ultimate cause of the vibration

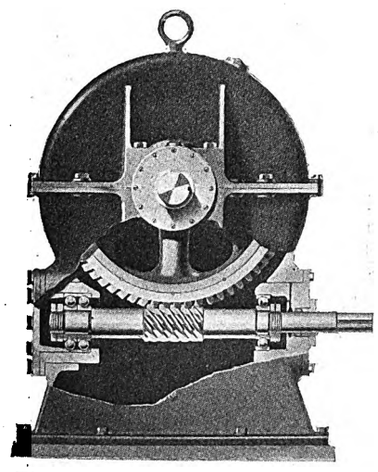
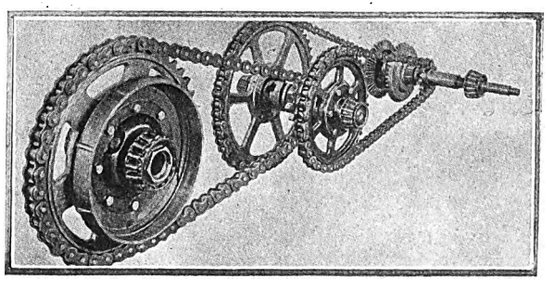


Fig. 2. Above—A worm and gear drive cut-away to show relation of gear teeth and ball bearings for thrust purposes on the worm shaft.

Fig. 3. Below—An arrangement of chain and bevel gears. Lubrication of such elements is important.



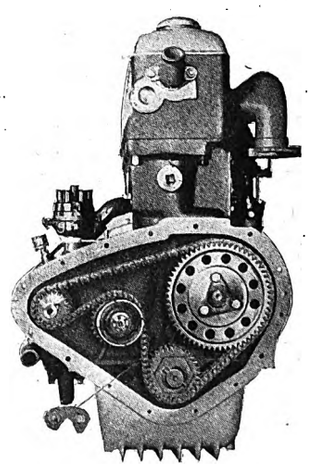


Fig. 4. Above—Silent chain and gear connection on the front end drive of an internal combustion engine. Such mechanisms are usually lubricated by the motor oil.

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1. To transmit power.
2. For the changing of speeds.
3. In changing the direction of rotation of any particular part, and
4. To change the point of application of the power which is being transmitted.

While the transmission of power by means of gears in theory involves purely rolling motion between the surfaces of the gear teeth, in practice there will always occur a certain amount of sliding motion as well, especially as the teeth engage and pass out of mesh. Sliding motion imposes considerably more wear on the surfaces in contact than does rolling motion. For this reason, it is wrong to regard gear lubrication as of relatively minor consequence: no surfaces will wear more rapidly than two which are in sliding contact. Therefore, since friction of this nature will depend on the accuracy of design and construction, the alignment of shafting and the freedom and smoothness with which the gear teeth engage or mesh, it is natural to assume that wear will occur in like proportion. Of course, the essence of efficient gear operation is to have the gear teeth roll so smoothly into each other, with such a constant relation in velocity between the two wheels and their corresponding shafts, that friction is reduced to a minimum. The lubricant in such a case will serve to equal extent in the reduction of noise and vibration and in the prevention of undue friction and wear. In other words, the efficiency of any type of gear drive will depend upon the extent to which friction and wear is overcome by means of correct design, proper construction and careful lubrication. The advantages of efficient gear lubrication which will result are:

1. Noiseless operation.
2. Minimum vibration and shock between the teeth.
3. A minimum of wear with a corresponding increase in the life of the gears,
4. Therefore, less wear on all adjacent operating parts which are affected by the rolling of the gears, and
5. Maintenance of gears at their designed strength and capacity for work throughout their life.

Gears will vary in design, principle of operation and their manner of construction. As a result, the term "gearing" is broadly extended by many to cover any form of friction, chain

(*Continued on page* 55)

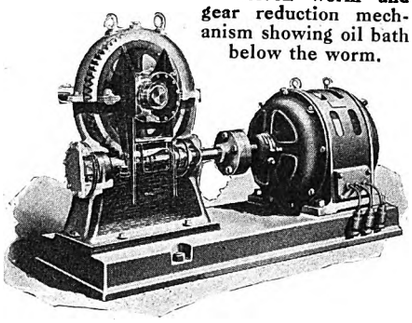


Fig. 9. Below—A motor-driven worm and gear reduction mechanism showing oil bath below the worm.

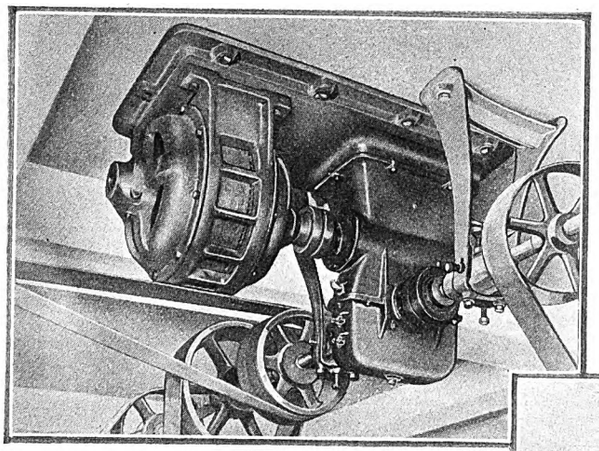
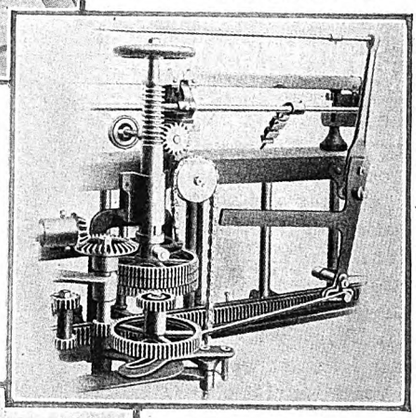


Fig. 10. Above—Illustration of a motor-driven worm reduction geared line shaft drive. A special housing provides lubricant for the gears.



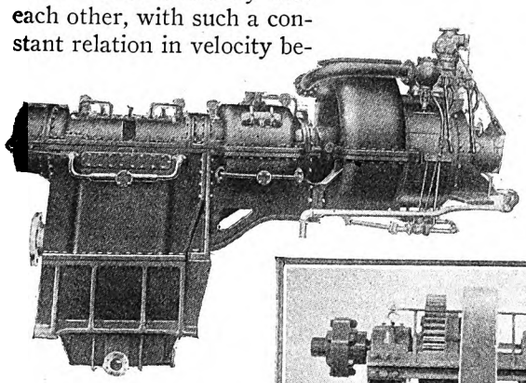


Fig. 11. Above—Turbine reduction gears as used in connection with large turbine units, fully housed.

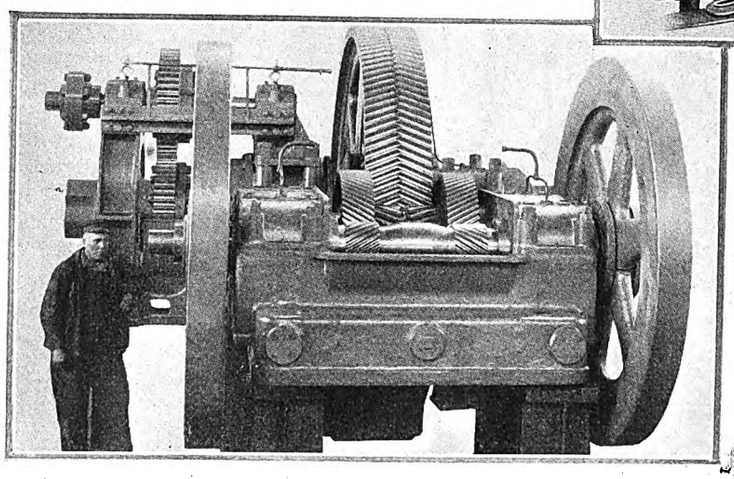


Fig. 12. Above—Showing spur and bevel gearing, as well as rack and pinion arrangement on a tension regulator of a (textile) roving machine.

Fig. 13. Arrangement of herringbone reduction gears. Note, also, spur gears to left. Forced lubrication is often employed on large gears of this type.

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How They Solve Their Packing and Shipping Problems

By John H. Van Deventer



THE name of the Shipping Department of the General Electric Company at Schenectady does not fully describe the functions embraced by this unit's activities. This will become readily apparent when it is learned that these functions include, mainly, (1) the maintaining of a stock of complete units of finished product for application on customers' orders; (2) packing material preparatory to stocking or shipment; (3) the assembling from different manufacturing sections, of finished products, preparatory to the final shipment to customer, and (4) actual shipment from the plant of material destined for customers or other plants and warehouses of the General Electric Company.

The principal unit of the shipping department is located in a main warehouse and despatching point, building No. 50 situated in almost the geographical center of the plant and there are also eighteen subsidiary packing rooms, shipping points and warehouses, distributed at strategic points throughout the plant, special thought being given to their location in order that they may be near points where manufacture of apparatus is completed. The total floor space amounts to nearly 350,000 square feet, including buildings, sheds and covered platforms. About fifty per cent of this space is used in storing warehouse stocks. The loading facilities permit the simultaneous loading of 97 freight cars, of which the main shipping building can accommodate 36. The average number of employes usually required to accomplish these functions is about 500, including office and factory help.

In and adjacent to the main shipping building No. 50 are nearly one mile of narrow gauge railroad tracks. Of the 36 cars which can be loaded from the platforms of this building, 6 are taken care of indoors and the remaining 30 on the outdoor tracks—the car floors being flush with all loading platforms. Two standard gauge tracks with a total of 280 ft. enter the southern end of the building and three narrow gauge tracks run practically the whole length of the building on the first floor. There are ten turntables to accommodate the crisscross tracks which run at right angles with the main tracks. One of these tracks runs through three of the 14,000 lb. freight elevators, and loaded narrow gauge freight cars are taken to the upper stories. Here, by means of still other turntables, the cars can be run to all parts of the floors. Each freight elevator can accommodate one narrow gauge car. Among other materials, one of these freight elevators handles the 20 to 30 tons of excelsior used in the factory every day.

For the heavy lifting there are 25 electric cranes, including an outdoor gantry crane running on rails 50 ft. apart. Its operating radius is, however, greater, due to a 15 ft. overhang. This crane can lift a narrow gauge car off its rails and deposit it on the narrow gauge tracks leading into the side of the building, so loaded cars can be brought into the building without entering by the



Fig. 1. Stock of standard goods in standard quantity packages in the stockroom, showing the "directory card" on each end of a pile.



Fig. 2. Checking stencil against requisition, in the shipping department.

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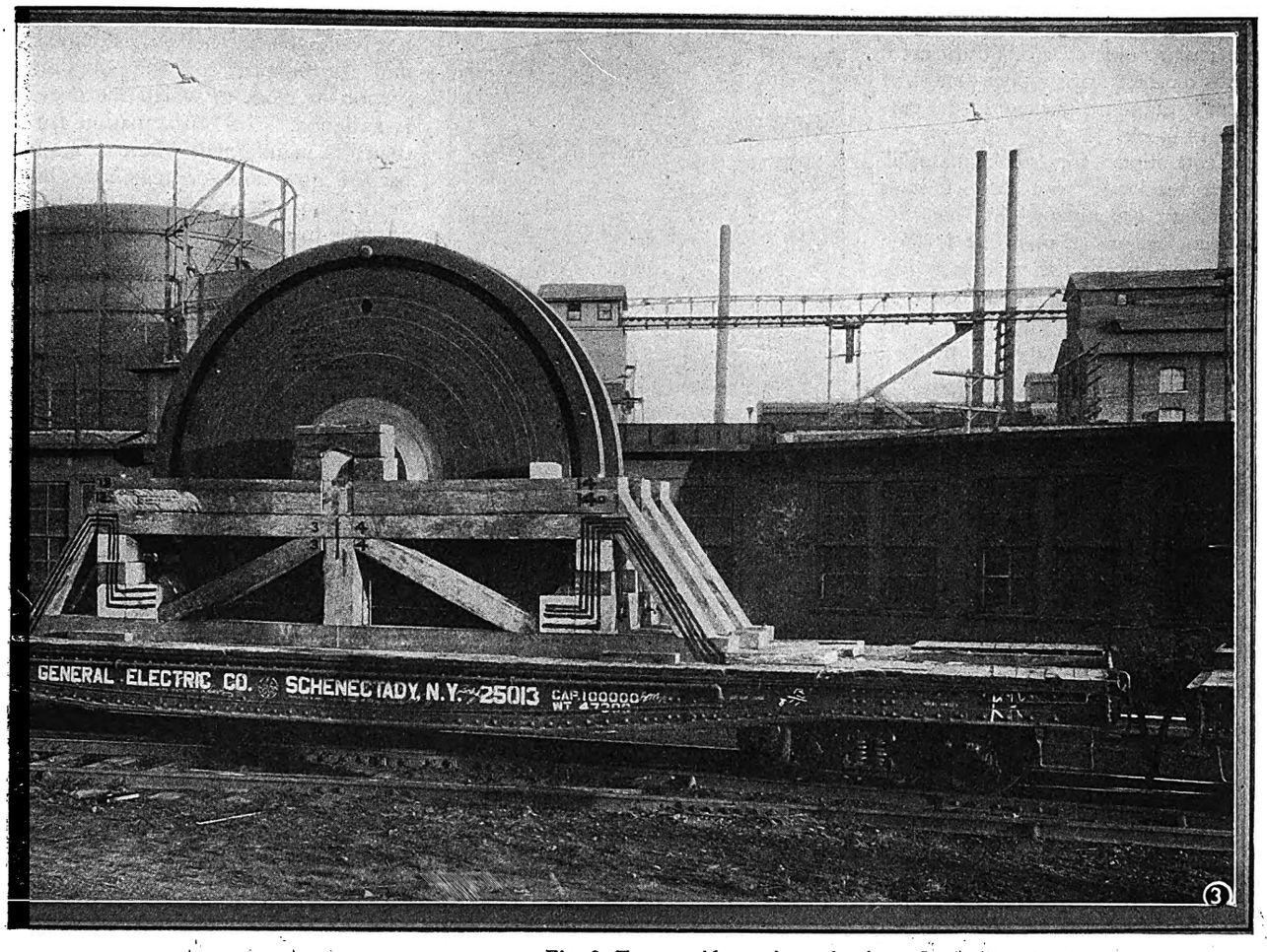


Fig. 3. Two outside sections of a huge flywheel, as blocked and braced for export shipment.

regular tracks at the end. The electric cranes, 25 in number, carry from 30 tons down to one ton. The smaller ones are called rope cranes and are operated by the men handling the boxes.

A card index is kept in the Shipping Department showing the serial numbers and specifications of all induction motors ever sold by the General Electric Company. The value of this lies in the fact that a customer merely has to give the serial number of his motor to enable the shipping department to send him spare parts, in spite of the fact that his motor might have been sold him many years before.

As a matter of fact, a large portion of the orders received by the General Electric Company can be filled from warehouse stocks similar to the one



Fig. 4. Nearly 1,000 questions are handled daily by the shipping department information bureau.

Fig. 6. Below—A zinc cylinder covering for export shipment of rotor and shaft.

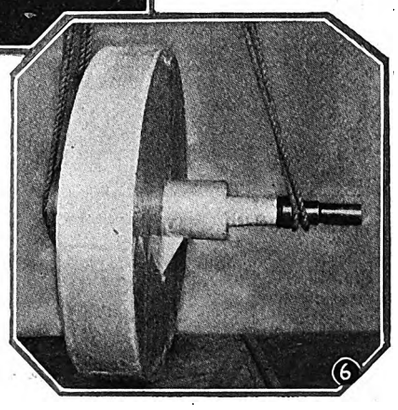
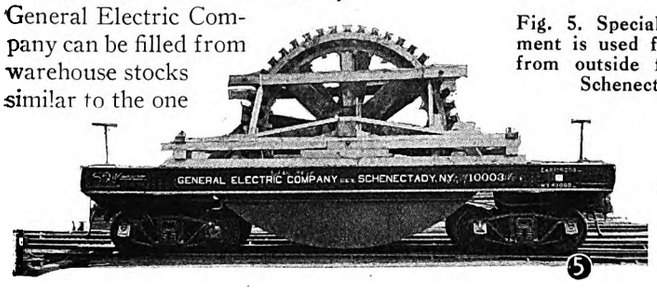


Fig. 5. Special railway equipment is used for large castings from outside foundries to the Schenectady plant.



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maintained in this building. At this particular point over 5,000 different kinds of electrical supplies—most of them in standard packages—are carried in stock.

Requisitions for stock material, when received from district sales offices, are accompanied by four carbon copies, and a manifest is then made out listing the various requisitions received. This manifest is used for record purposes. The orders are then separated into two classes; express and small orders and freight and parcel post orders. The freight orders are then routed and parcel post zones stamped on. All orders are then assigned by a Requisition Distributor to the proper shipping sections, of which there are thirty. The orders are then passed to a girl for card-indexing. On this record is shown the number of the requisition, the name of the office from which it came, the date received, the method of shipment and the number of the shipping section or clerk to which the order is assigned. An "Information Bureau" is maintained, where a number of girls answer telephone inquiries on any orders. This they are able to do by means of the cards referred to, kept up to date as to the status of the order up to the time it is shipped to the outside.

To return to the requisition, it next is passed to the stock record clerk who makes proper entry on stock cards and determines whether or not the material is available for shipment from warehouse stock. In the event that it is, the order is delivered direct to the stockroom where the boxed apparatus is selected, stenciled and loaded on outgoing cars.

After the stock clerk has finished with the order, it is sent to a typist in the main shipping

(*Continued on page 86*)

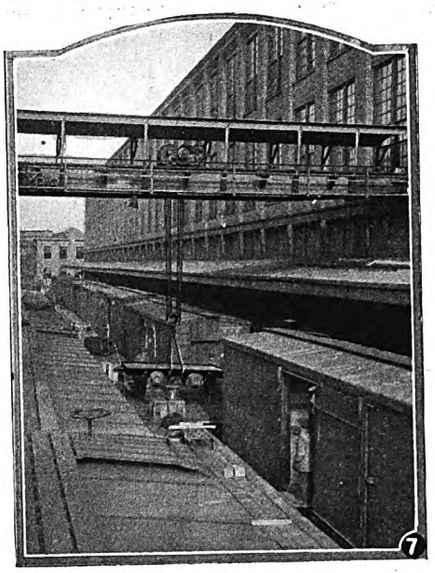


Fig. 7. Crane lifting an empty narrow gauge freight car.

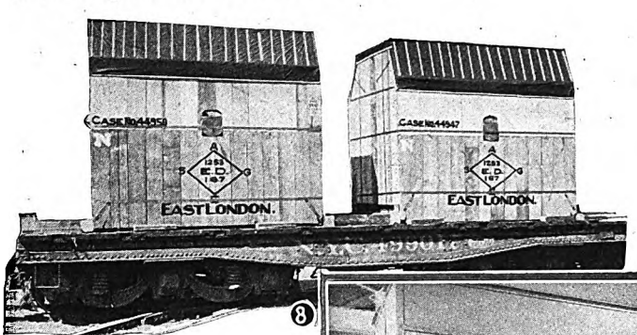


Fig. 8. Armatures, boxed and on car, for shipment to South Africa.

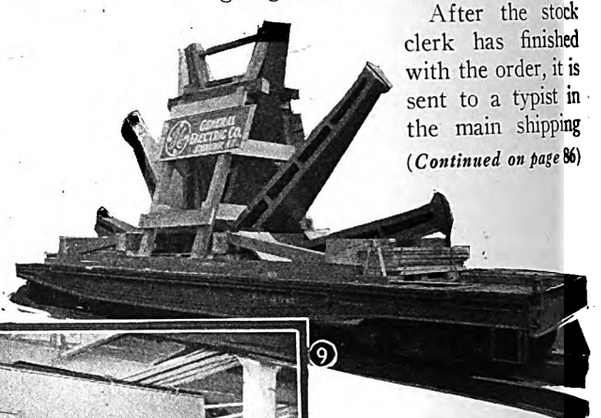


Fig. 9. One half of a rotor spider; a clumsy unit to make secure for shipment.

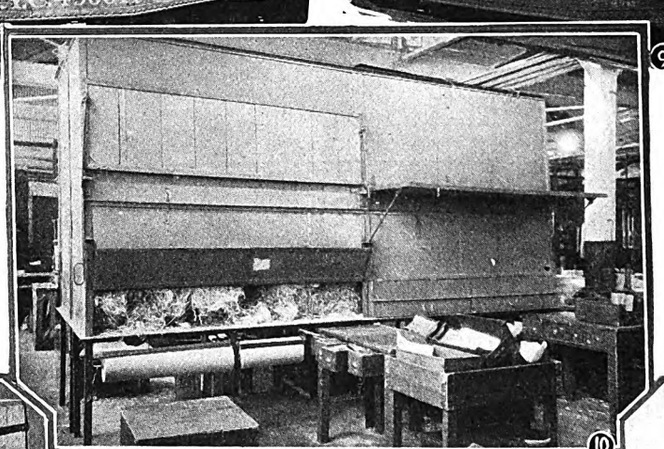
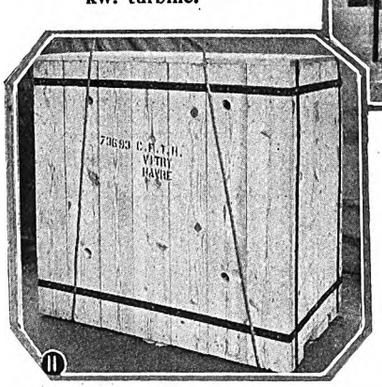


Fig. 10. The equipment in the packing department is not only ultra modern, but is arranged to expedite the work.

Fig. 11. Below — Export packing of an oil tank and turbine standard of 12,500 kw. turbine.



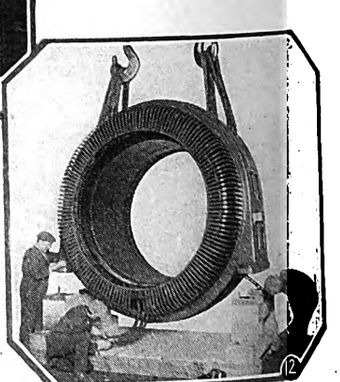
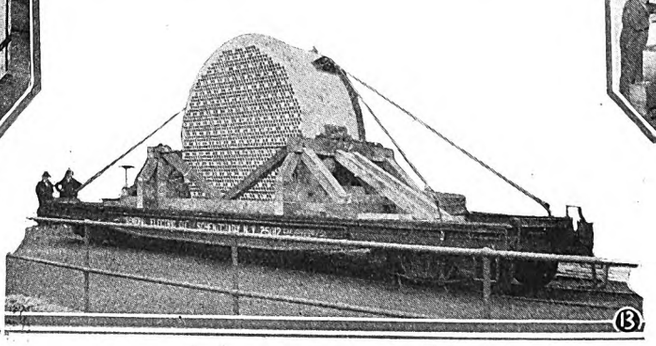


Fig. 12. Preparing to pack a large stationary armature for export shipment.

Fig. 13. At the right—Domestic shipment of mercury boiler, to Hartford, Conn.



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Trucks Destined to Create a Mileage Record

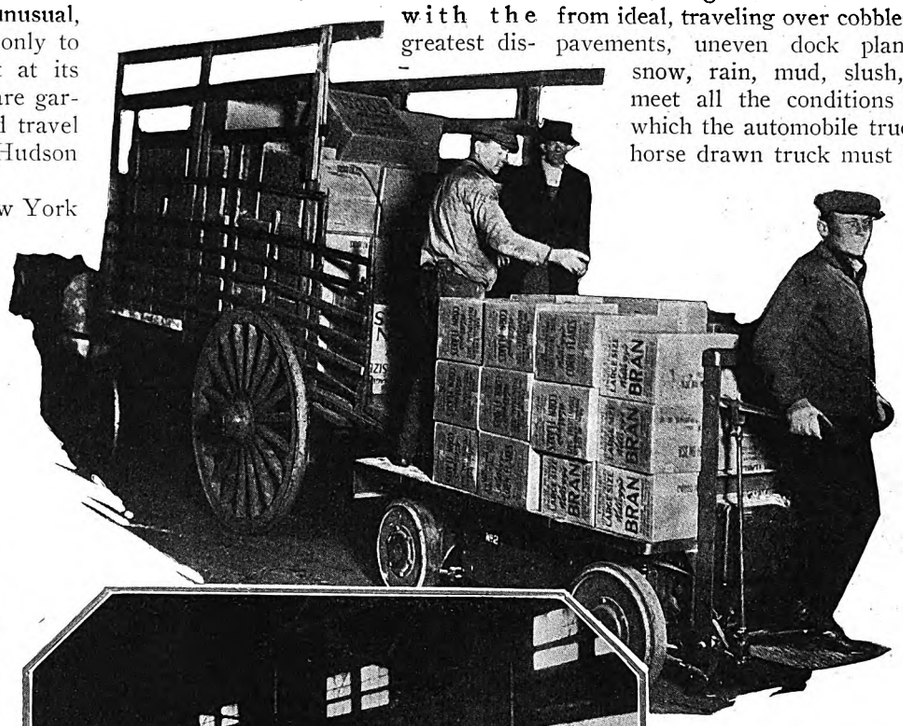
By F. C. Eibell

THE two electric industrial trucks shown here were recently installed on one of the freight carrying boats of the Central Hudson S. S. Company of New York City. Their application is unusual, in that they are used not only to load and unload the boat at its New York pier, but they are garaged on board the ship and travel with it up and down the Hudson River.

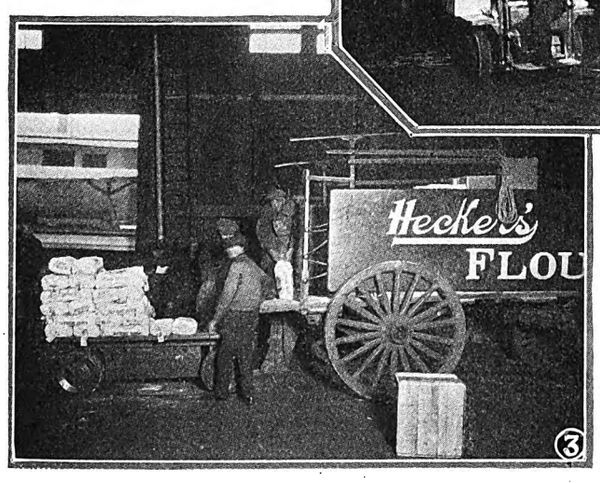
The boat is loaded in New York City with between 700 and 800 tons of freight by the two high platform electric trucks and all freight must be on board before 4 P. M. Four stops are made on its trip up the Hudson—Newburgh, Beacon, Poughkeepsie, and Kingston—at each of these places the two trucks unload the freight and pick up cargoes destined for the stopping places along the route.

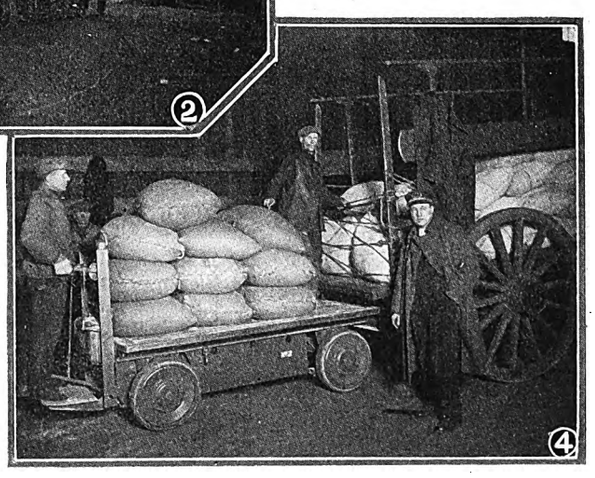
During the trip from New York City to Newburgh, and on the runs between Newburgh, Beacon, Poughkeepsie, and Kingston, the trucks are connected to the charging panel which has been installed on board the ship, and their batteries are kept well charged by this arrangement.

Plenty of work is the rule for these trucks, for they must handle the work on and off of the boat with the greatest dispatch. It should be noted that the trucks must climb a steep ramp at times due to the condition of the tide, that they must handle a miscellaneous cargo under conditions far from ideal, traveling over cobblestone pavements, uneven dock planking, snow, rain, mud, slush, and meet all the conditions with which the automobile truck or horse drawn truck must cope.









Figs. 1, 2, 3, 4. These two trucks, shown in the four illustrations on this page, probably travel further than any other pair of storage battery trucks—though not on their own power!

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Maintaining the Electric Lighting System

How Proper Maintenance Affects the Lighting Bills

By William G. Ziegler

GOOD artificial lighting is being given more and more attention, of late years, due to the fact that most managers realize that it increases production. If a plant is not properly lighted it is safe to assume that an increase of from ten to twelve per cent. in production may be counted on by installing a correct lighting system, and the operating cost of this system is usually only about two per cent. of the payroll. The effect of proper lighting on the workmen is another very important point, for they are sure to be more contented in a well lighted plant. Proper lighting also tends to reduce spoiled work because the men can see better, and in some cases this may amount to twenty-five per cent. less spoilage with correct illumination. The records of accidents also show that about twenty-five per cent. fewer accidents occur when correct lighting is in effect. Some states have adopted lighting codes, as they have recognized the fact that good lighting has a tendency to make plants safer for the men. The men are more cheerful in well lighted plants and this is reflected in their better health. The codes usually specify the minimum intensities allowed for the various operations and also suggest higher intensities which are desirable. The intensities recommended now by competent engineers are almost double those of five or six years ago because the high peak of war production showed that intensities much higher than ordinarily used were largely instrumental in getting out more than normal output.

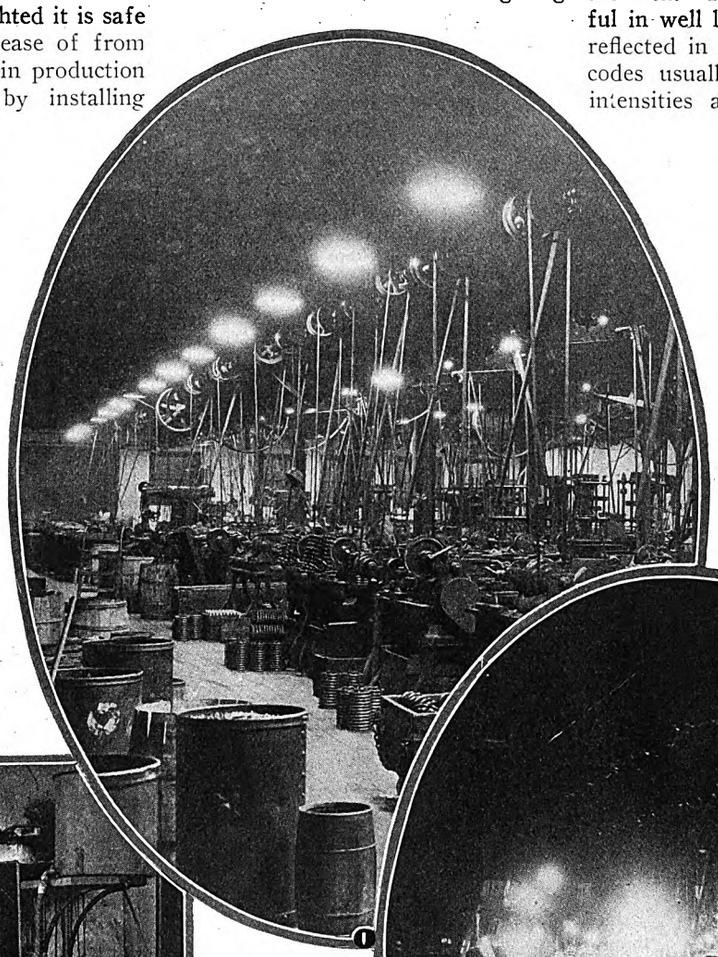


Fig. 1. Even, shadowless light is the important factor. Contrast this with Fig. 2, which shows the same shop under former conditions.

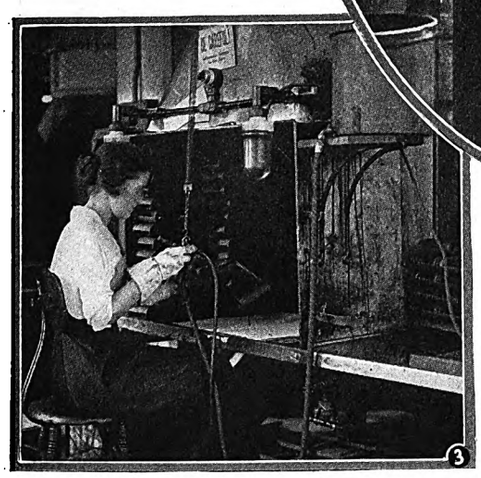


Fig. 3. Explosive fumes require a fully enclosed lamp, which may be installed as close to the work as necessary.



Fig. 2. With plenty of light directly on the work, yet the deep shadows and the eye-level glare are bad features.

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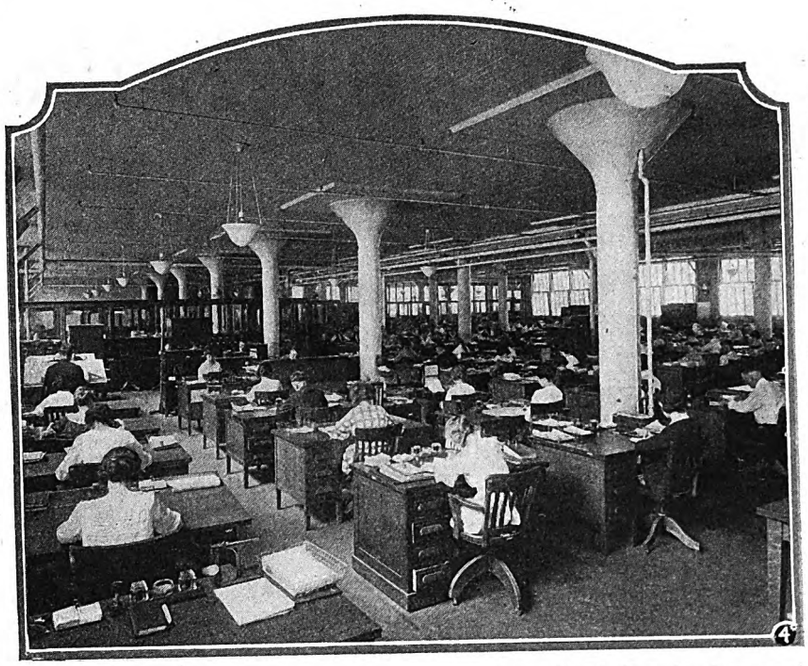


Fig. 4. Open bowl type of semi-direct units must be kept clean, as they collect a large amount of dust.

The relationship of mounting height and spacing distance, to give uniform illumination over the entire area, has been thoroughly worked out by the manufacturers of lighting equipment and this data is available for all types of fixtures. For direct lighting units it is usual to install the unit as high as possible in order to get more cross light, and therefore less dense shadows. Where overhead belting is in place the units should be installed at the height of the lowest horizontal belting. In maintenance work it is often desired to use present outlets but to increase the intensity of the illumination. If the ceilings are too low it may not be possible to obtain even distribution when the new larger units are used and in such cases calculations should be made and more outlets installed.

The increase in production due to correct artificial lighting is dependent on whether the operations are manual, semi-automatic or automatic. On operations requiring manual effort and constant use of the eyes it will be evident that the increase in production will be much larger than on semi-automatic or automatic work. On automatic or semi-automatic work the time of the automatic part cannot



Fig. 5. Probably the most intensive research work on proper lighting was first undertaken for retail stores; from many of which we can learn much of value to industry.

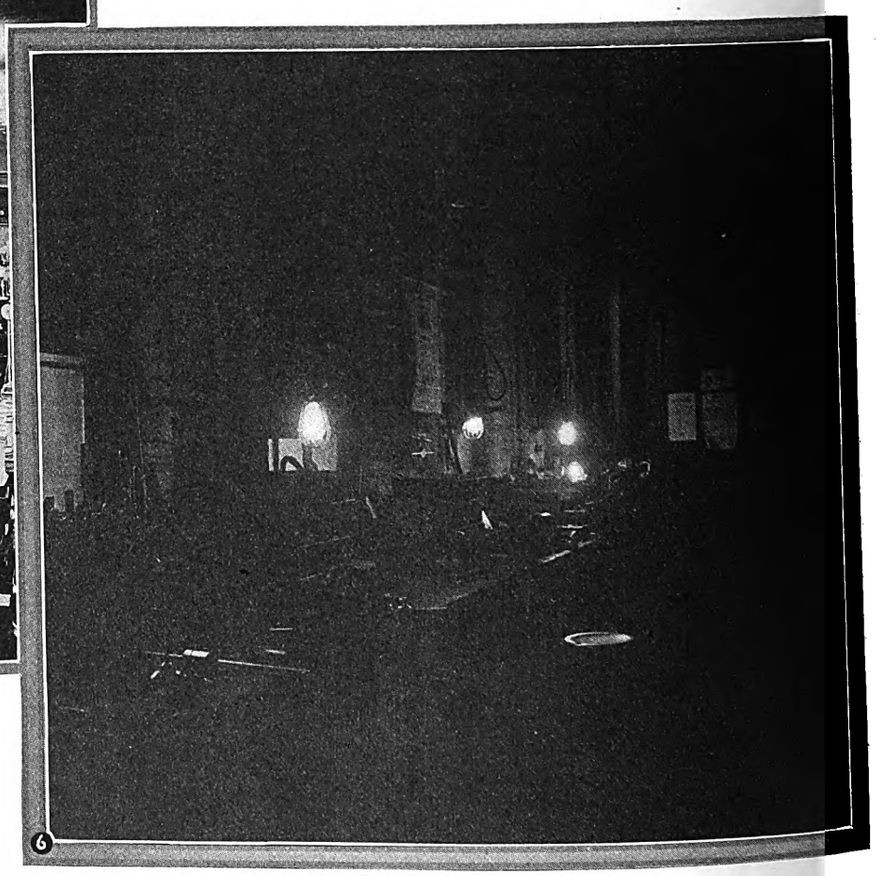


Fig. 6. These direct individual drop lights seemed a logical thing, until—

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be reduced by more light, but the manual part, such as adjusting and setting, will be made faster.

From the safety standpoint general illumination of a reasonable intensity is necessary in all plants. Many accidents are caused by falling or stumbling over obstructions. These obstructions are more easily seen in a well lighted shop, thus tending to avoid accidents. Modern practice provides for a high intensity of general illumination from overhead units with no local lamps, and this practice tends to promote safety and reduce accidents. The records of insurance companies show that the most accidents occur during the winter when there is apt to be poor lighting during the long hours under artificial light. When explosive or inflammable materials are present, all lights should be enclosed for safety's sake. These protective units are made gas and vapor proof for certain requirements, and acid resisting for others where corrosive acid fumes are in the air.

Because correct lighting has a large influence on eye strain, health, amount of spoiled work and general safety of the men, it may safely be said that, other things being equal,

(*Continued on page* 98)

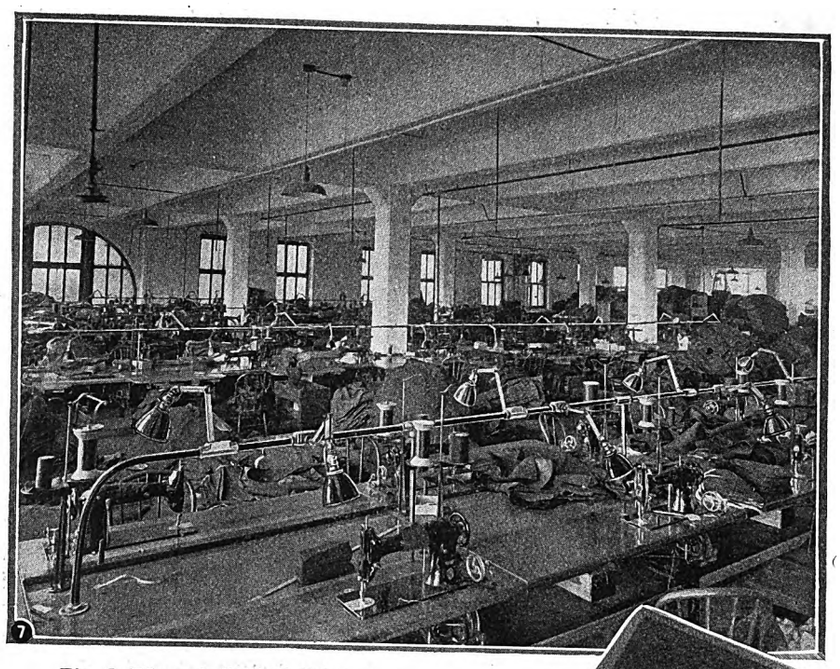


Fig. 7. Where individual lights are needed, it is well to select those which best meet the need, and they should be installed with every provision for safety.

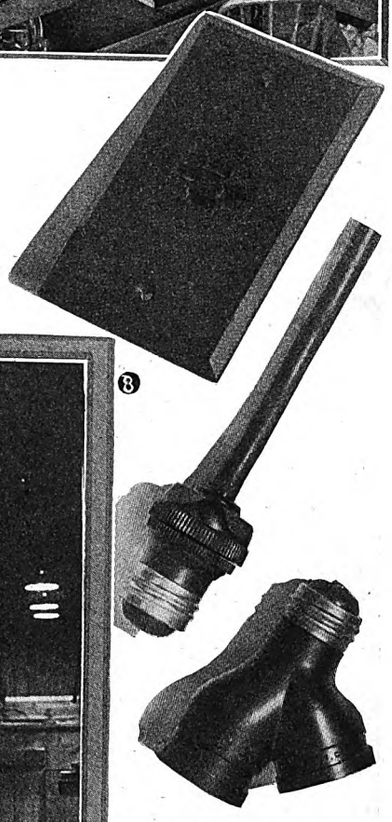


Fig. 8. There is no excuse nowadays for broken porcelain plugs and badly wired outlets.

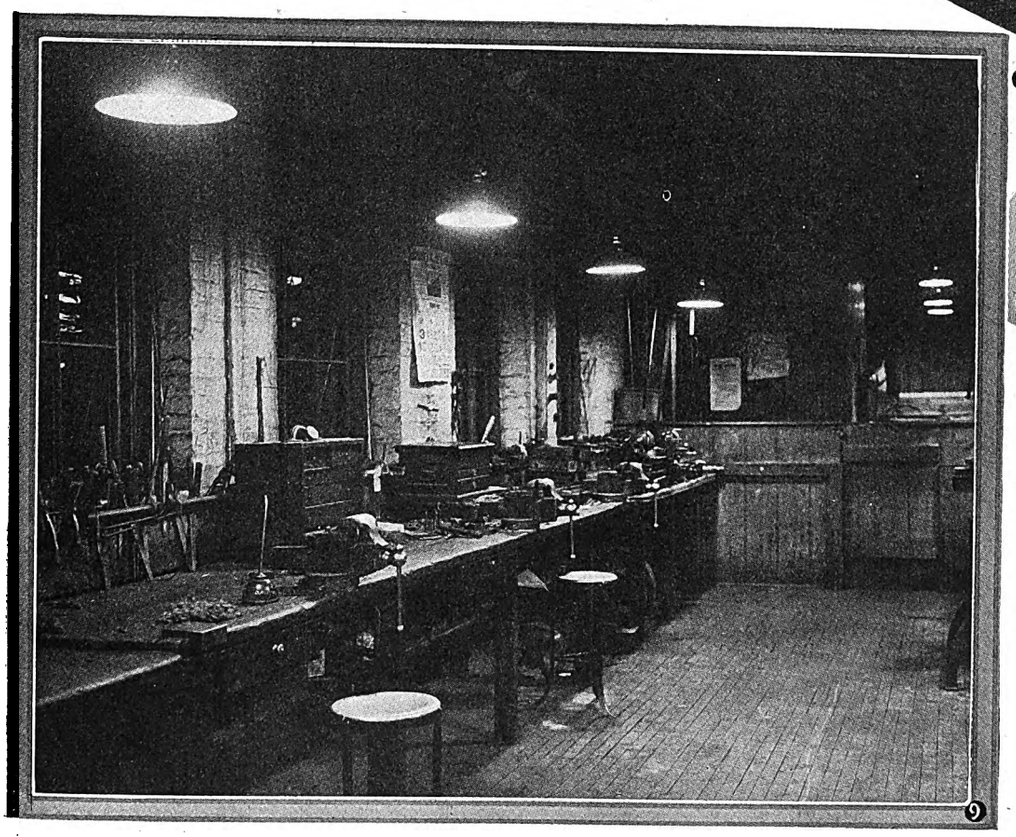


Fig. 9. —a lighting engineer showed what could be done to better them.

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Is There a Materials Handling Industry?

By Matthew W. Potts

ABOUT the year 1895 a new development in mechanical transportation entered the field and the manufacture of many different types of automobiles was the result. Every small machine shop that saw the advantages of this new means of locomotion set about to develop and perfect a model. Within ten years many of the original makers had gone out of business and a number of old established carriage builders were producing cars. In due course it became necessary to bring about standardization in order to meet competition and many individual companies went into combinations. Today the number of manufacturers of automobiles has been greatly reduced and the so-called standard cars are produced in quantity lots in factories built especially for their manufacture. This has all been a direct process of evolution and today we have a well established automotive industry with a well or-

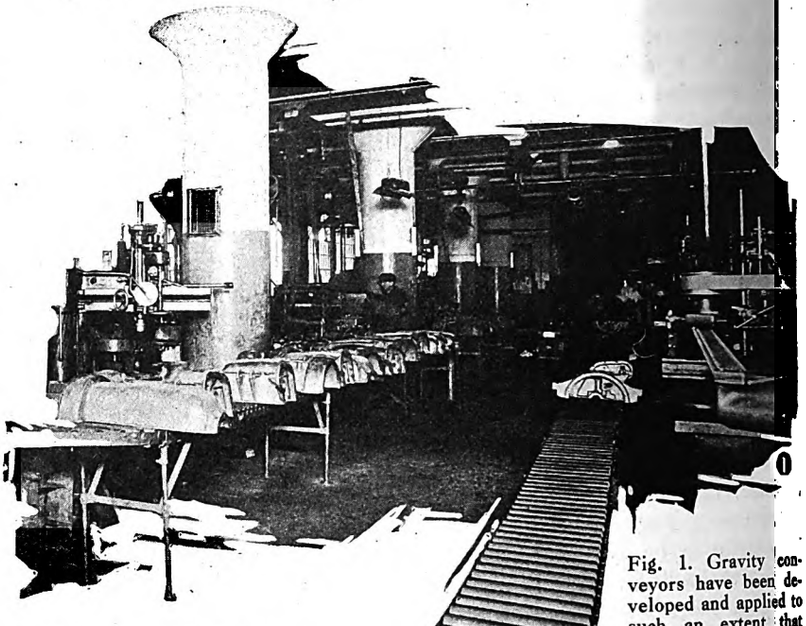


Fig. 1. Gravity conveyors have been developed and applied to such an extent that they are now considered a part of the equipment for machine shops.

Fig. 2. Belt conveyors have been used so many years for handling bulk materials that some believe there is a Belt Conveying Industry.

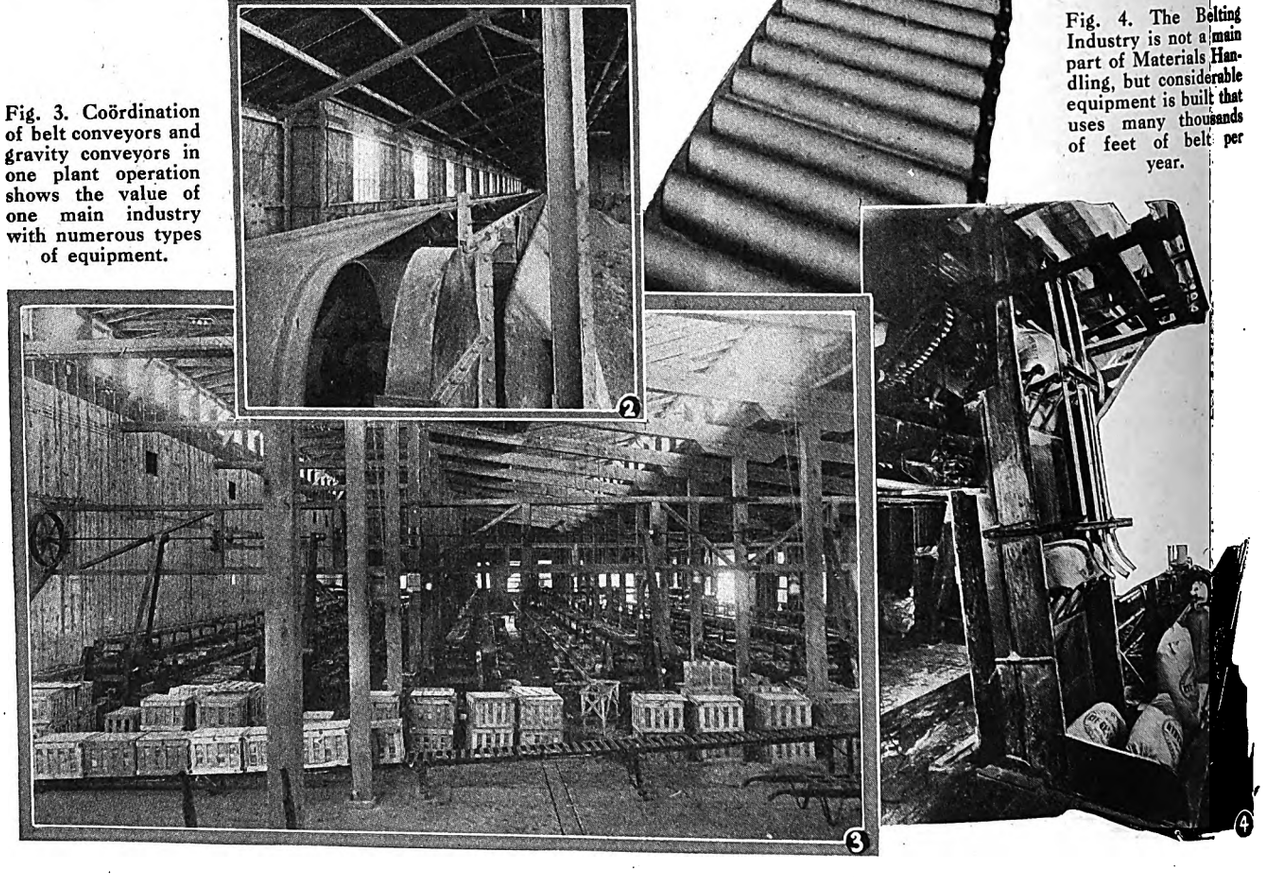


Fig. 3. Coördination of belt conveyors and gravity conveyors in one plant operation shows the value of one main industry with numerous types of equipment.

Fig. 4. The Belting Industry is not a main part of Materials Handling, but considerable equipment is built that uses many thousands of feet of belt per year.

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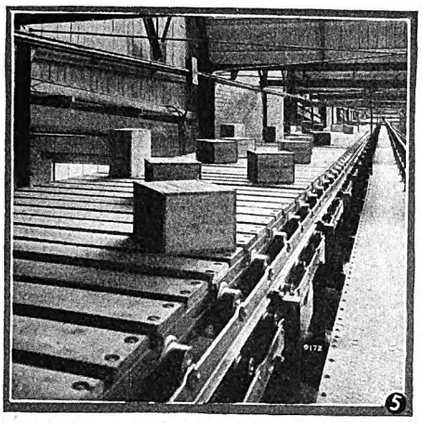


Fig. 5. Some materials as shown would not handle well on belts, so platform conveyors are employed. This type of equipment uses several types and makes of chain, both steel and malleable.

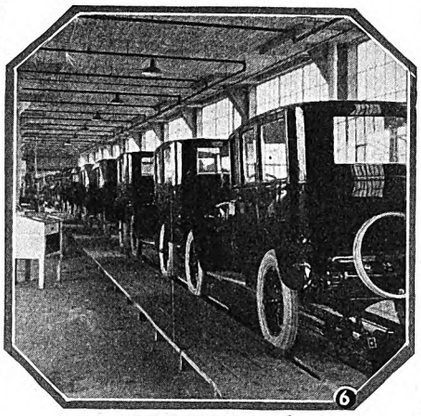


Fig. 6. Here, again, is a different type of conveyor where chain is employed as the moving agent.



Fig. 7. Lift trucks operated by hand are complete within themselves, but is the volume of production great enough to warrant a separate industry?

ganized system of distribution, sales agencies, and service stations.

Is it too much to predict that within the next generation the same thing will happen in the materials handling equipment field? With this thought in mind let us review the past years and consider the new developments and standard equipment that are now being produced.

Let us first look at and consider the development and application of gravity conveyors as shown in Fig. 1. This equipment is now produced by several manufacturers, each using the same principle but differing slightly in construction. These small differences are used as selling points to indicate superior quality, and to justify the higher prices. It is true that for some class of work only the highest type of perfected gravity conveyor should be used but there are a number of handling operations where the cheaper grade has many advantages, particularly if the equipment is to be used

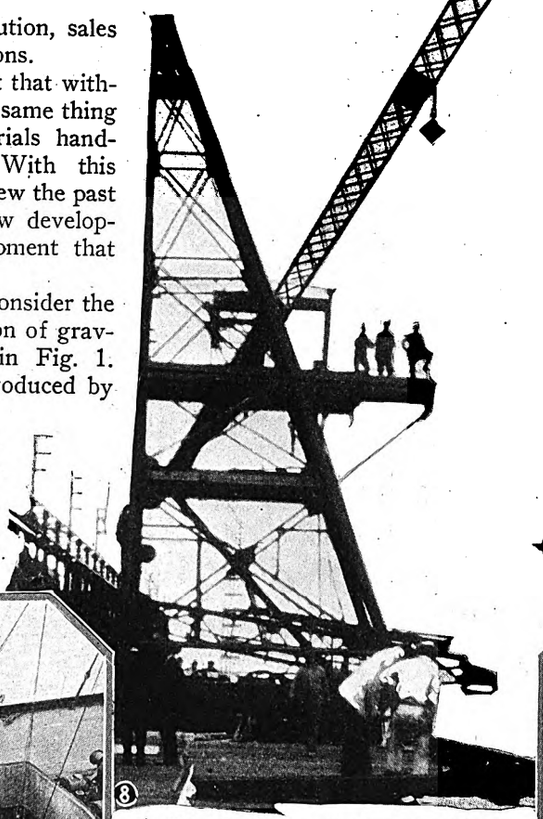
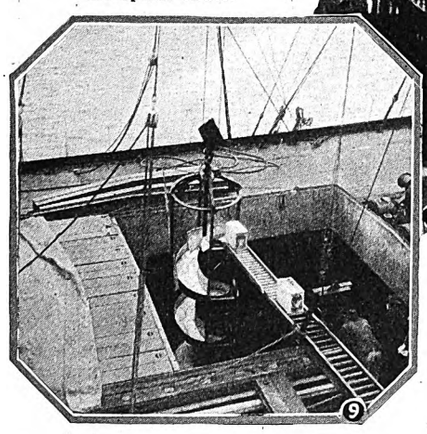


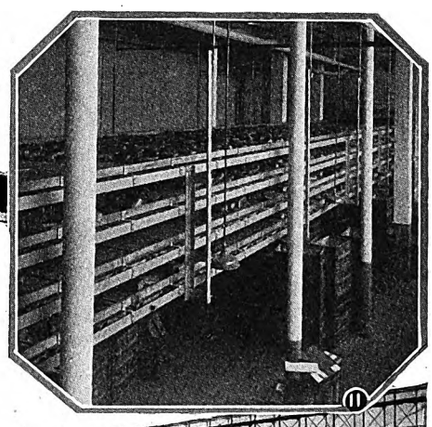
Fig. 8. Close-up view of the installation in Fig. 10, showing the full length of spiral chute.

Fig. 9. Gravity conveyors carry the boxes over the marshes and also from the belt conveyor to the spiral chute.



Fig. 11. Industries like to have the equipment fit their particular needs. This cooling conveyor was designed and built for use in bakeries.





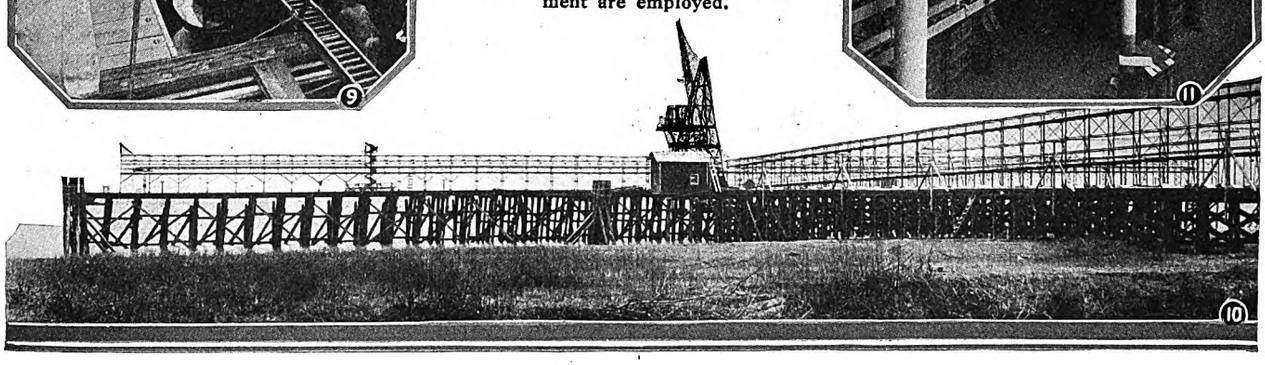


Fig. 10. A general view of a large scale materials handling installation where four or five types of equipment are employed.

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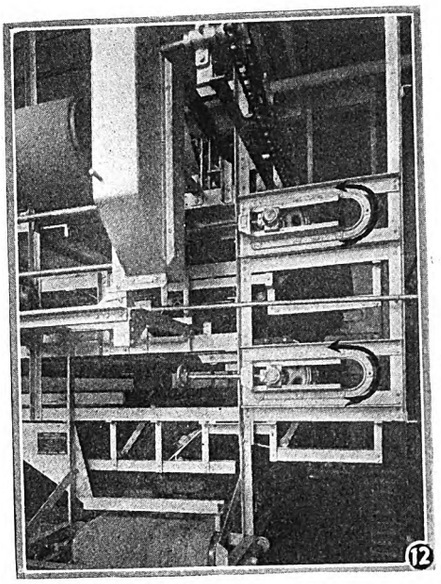


Fig. 12. View showing feed and discharge end of cooling conveyor shown in Fig. 11. Note that belt conveyors bring the bread to and take it away from the special equipment.

for only a short time and not given the proper treatment.

Gravity conveyors have been developed and applied to such an extent, that they are now considered a necessary part of the equipment for well organized machine shops, shipping rooms, packing rooms; in fact they have their field of operation in practically every industry. This is also true of belt conveyors and as belts have been used for many years for handling bulk materials, some manufacturers believe that there is a Belt Conveyor Industry.

It is at this point that we first see the need of a Materials Handling Industry so as to bring about a proper coördination of various types of equipment. Looking at Fig. 3 we see more than one type of conveyor performing handling operations within a fruit canning factory. At the present time there are several companies who manufacture and sell both the belt conveyors and gravity conveyors and are therefore capable of making a satisfactory conveyor layout as shown, but as will be pointed out later, conveyors are only a small part of the equip-

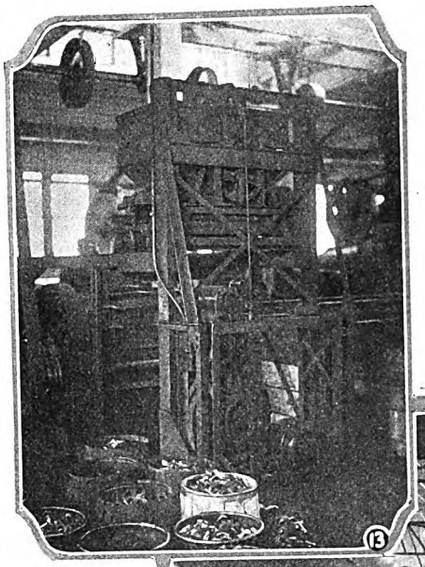


Fig. 13. The principle of a tiering machine was employed to make a special machine to fit the job.

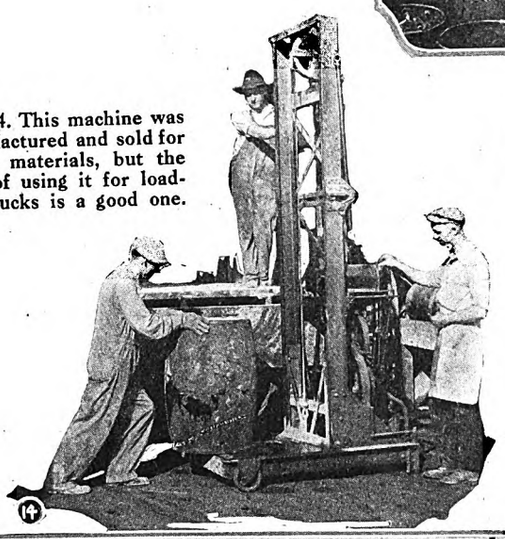


Fig. 14. This machine was manufactured and sold for piling materials, but the idea of using it for loading trucks is a good one.

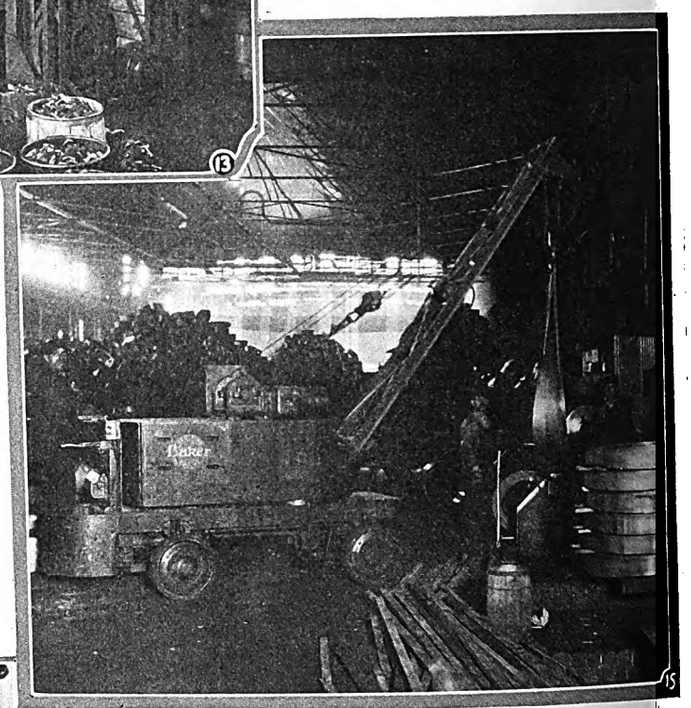


Fig. 15. The electric storage battery truck manufacturers started with one or two types. Today they make many different types for numerous operations.

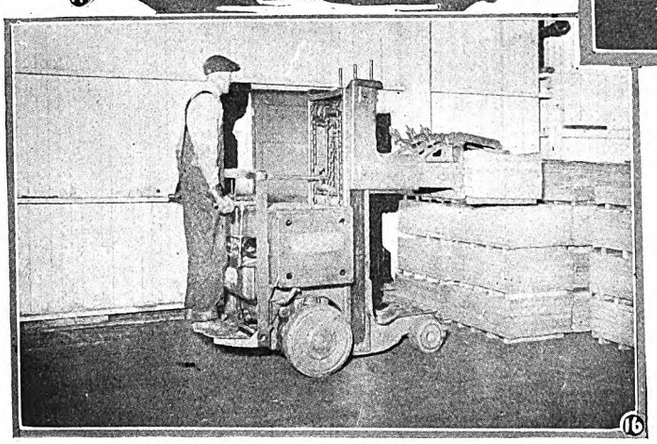


Fig. 16. Many industries are now calling on materials handling equipment manufacturers to solve their problems. This special lift truck platform was designed to handle sheet tin.

Fig. 17. This equipment will handle different diameter reels. Attention is called to the adjustable supporting mechanism.



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ment that is required in most installations properly to handle materials.

There is, however, a great deal of interest being shown by the Belting Industry in the future of materials handling, especially in regard to the use of their product, and one large manufacturer has published a book on the use of their belt on various types of conveyors. Another manufacturer has produced a belt that is used especially for the food products industries, such as bakeries, canneries, confectioners, etc., and in this way has materially built up the former business which was well established.

To show the many uses that can be made of belts attention is directed to Figs. 2, 3 and 4, and these are only a few, as belts are also used on bucket elevators, portable conveyors, package conveyors, and in practically every industry. One of the latest uses seen by the writer was in a meat market, where the belt conveyor carried the meat for a number of butchers to a wrapper, who was located near the cashier's desk.

The belt industry is not the only one affected by the increase in better handling methods, but the chain industry has also benefited and grown as many thousand feet of chain is used in a month to make several of the well known materials handling devices. The places where chains can be employed are at a point where the use of belts is not practical such as that shown in Fig. 5, where heavy cases are being handled. Here some form of platform conveyor is more adaptable

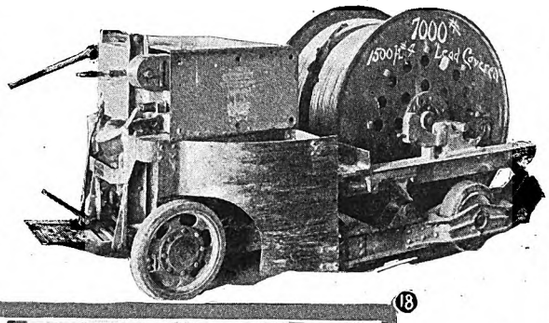
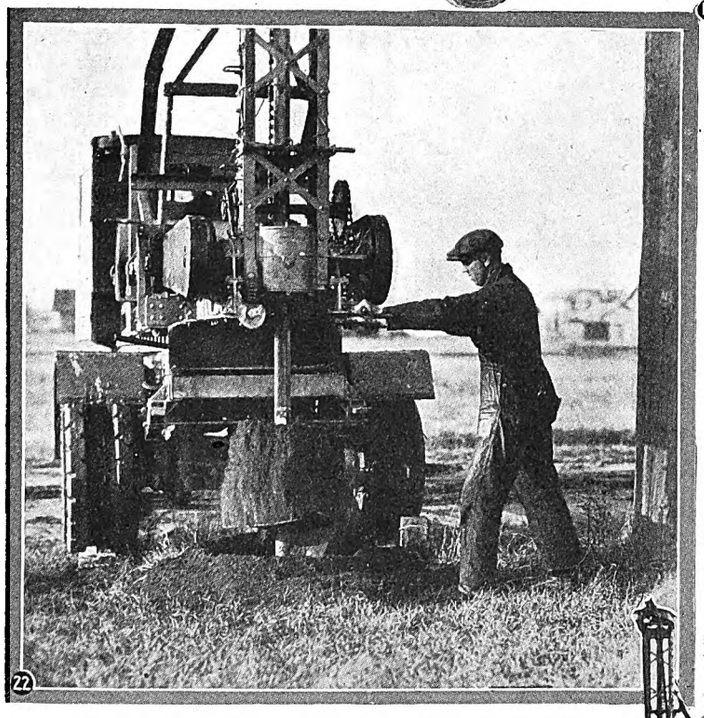
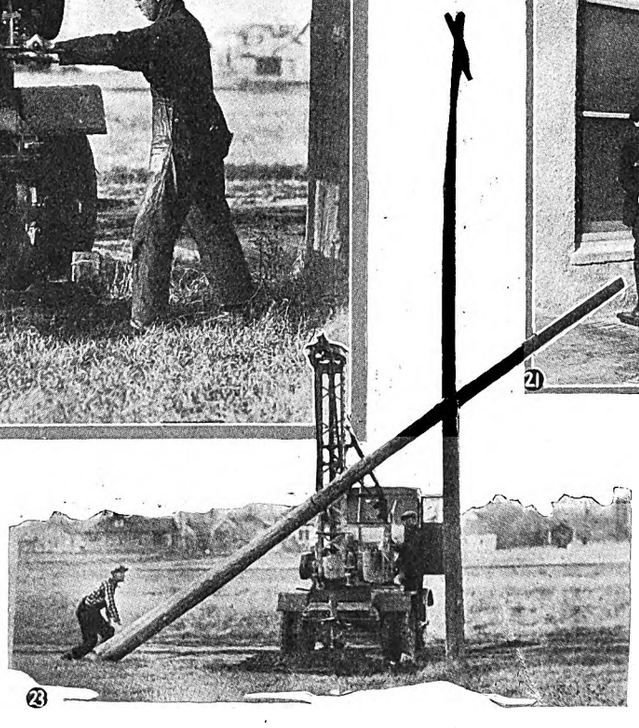


Fig. 18. A new type of electric storage battery truck for handling reels of cable.



Figs. 22 and 23. Motor trucks are now being equipped with many types of materials handling equipment. This hole digger and post raiser saves time and money and speeds up the work.



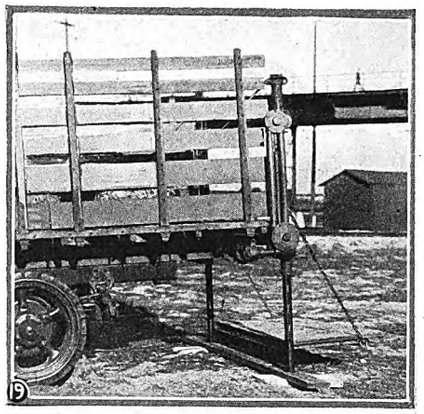


Fig. 19. When the truck is stuck, the elevated end gate (see Fig. 21) is reversed and becomes a jack.

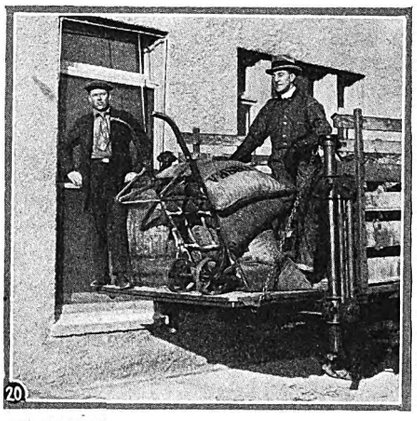


Fig. 20. Here the load is raised to the bed of the truck. This type of elevator is always with the truck to assist in the loading or unloading operation.

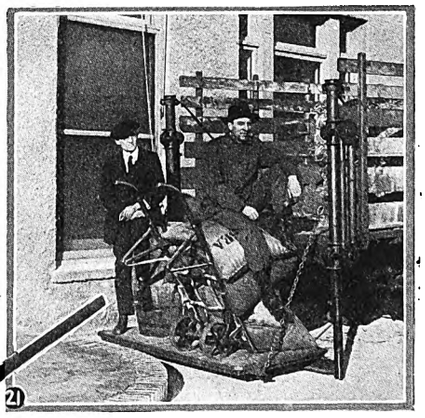


Fig. 21. This elevating end gate is driven direct from the truck engine. This shows it in the down position.

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than a belt conveyor would be.

The many different types of chains that are now being used in conveyors and elevators are being manufactured in several plants and frequently the same make of chain is used by more than one conveyor manufacturer. This is as it should be and is a sign of evolution the same as took place in the Automotive Industry when the manufacturers decided to use certain makes of wheels, certain systems of ignition, etc., so as to relieve their production and engineering department from the detail of developing and perfecting these parts. Chains as belts are used on many different types of conveyors and elevators and with a number of special attachments such as shown in Fig. 6.

There is today one type of equipment in the materials handling field that is more or less complete within itself and is produced intact by each manufacturer, and that is the hand lift truck as shown in Fig. 7. This equipment is compact and consists mainly of machined castings, forging, and standard shapes, which are finished and assembled into the complete machine. This equipment, however, cannot be produced in large enough volume to warrant making a separate industry and so it automatically would come in to the general industry, which must be formed, and which will deal with the economic handling service more than the type of equipment to be manufactured.

In order to make this point clear we present Figs. 8, 9 and 10, which show a complete layout and installation where several types of materials handling equipment are coördinated. This equipment was all furnished by one manufacturer and comes under the head-

(*Continued on page 90*)

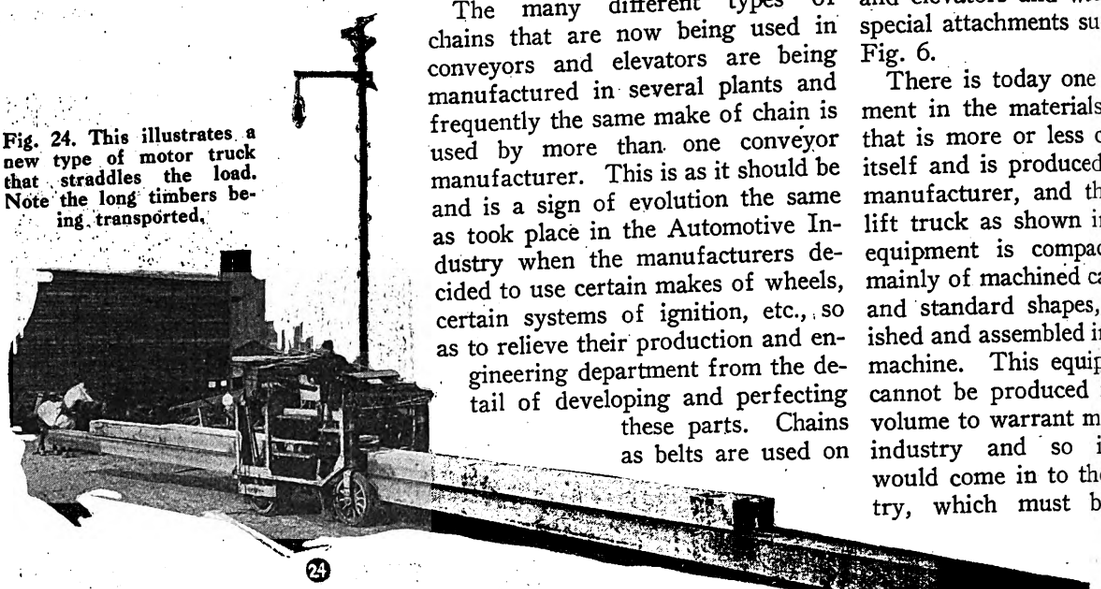


Fig. 24. This illustrates a new type of motor truck that straddles the load. Note the long timbers being transported.

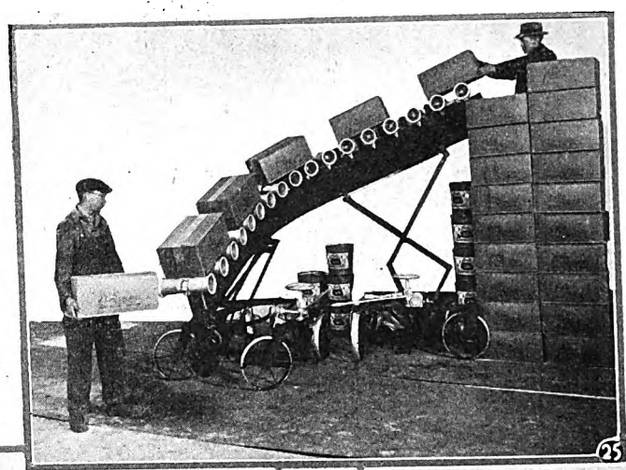
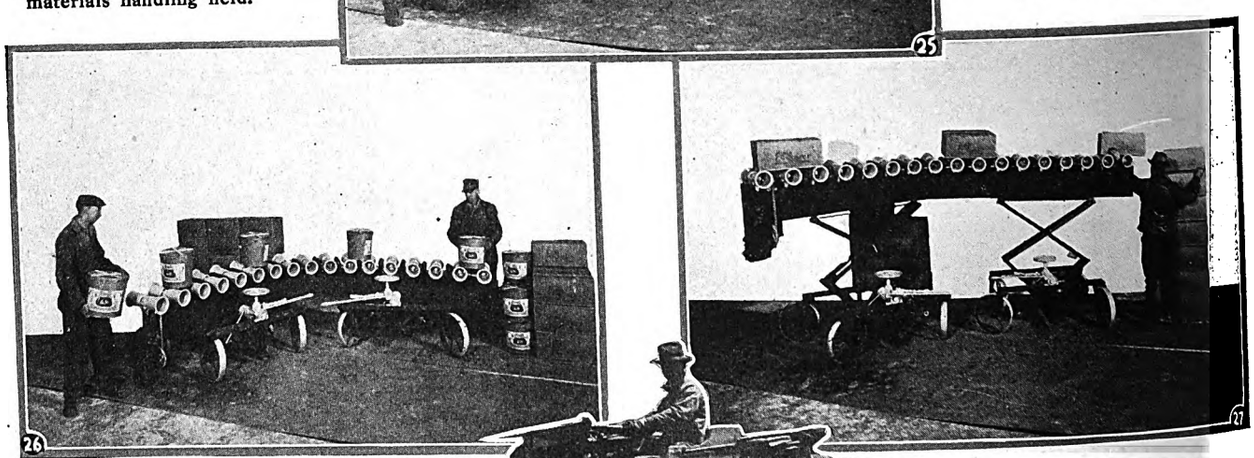


Fig. 25. To carry materials up and around corners at the same time is said to be possible with this new device.

Fig. 26. A continuous power conveyor that would run around corners is new in the materials handling field.



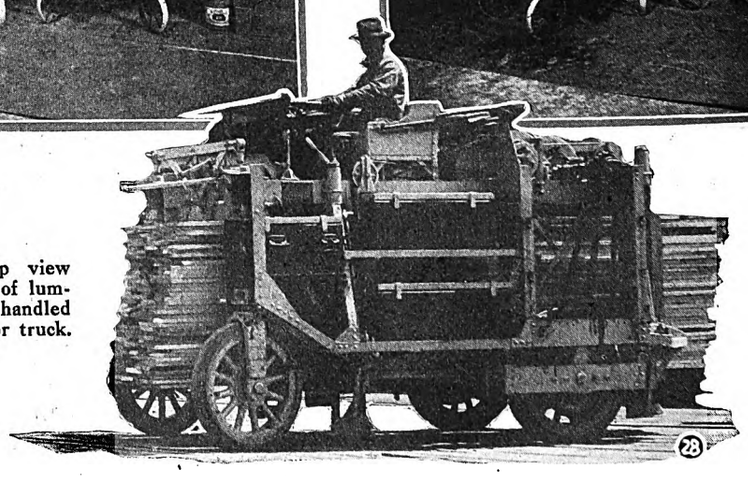


Fig. 28. A close-up view showing how a load of lumber (see Fig. 24) is handled by new type of motor truck.

Fig. 27. The adjustable stands are planned to make for greater fields of usefulness.

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Glare!

Now Eliminated

With 94 per cent Light Intensity Maintained

at Fraction of Cost of Shades

FOR years American Industry has been seeking some satisfactory method of eliminating glare. Shades are too costly. Allowing dirt to accumulate on the glass cuts down the illumination intensity only, while the glare is really aggravated.

But now industries are eliminating glare with Skyco No-Glare. And they are doing it economically—effectively, and with practically no loss in illumination intensity. Actual light measuring tests show that with glare eliminated with Skyco No-Glare illumination intensity is over 94 per cent normal.

Cuts Heat 10° to 15°

Skyco No-Glare is a bluish fluid that you either spray or brush on the glass. It forms a semi transparent film that diffuses the suns rays and absorbs the red rays. These red rays are the heat and glare rays. Thus the natural daylight is modified to an ideal, cool, restful light—the perfect light that has been striven for by much more expensive means. Glare is eliminated. And actual thermometer tests show heat is reduced from 10° to 15°.

Unaffected by Weather

Rain or weather conditions do not affect Skyco No-Glare. Neither will it rub, or flake, off. Yet you can remove it easily with warm water and a brush.

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You'll be surprised at the small cost of enjoying cool, non-glaring, restful illumination with Skyco No-Glare. A single gallon covers from 300 to 400 square feet of glass. The price is only $3.50 per gallon (less in quantities). It is guaranteed by the makers of the famous *Skybryte Liquid and Powder Cleaner.*

Special Trial Offer

To convince you of how economically and effectively you can banish glare and reduce heat we invite you to accept this trial offer:

Order one gallon of Skyco No-Glare at $3.50 F. O. B. Cleveland. Use as much as you wish. Note how easily it is applied. Mark how it defies weather conditions. See how easy it is to remove when occasion requires. Check up how much better work goes on when glare is banished and heat lessened. Then, if you are not delighted, return the balance at our expense and we will cancel invoice.

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The Brand of Valor

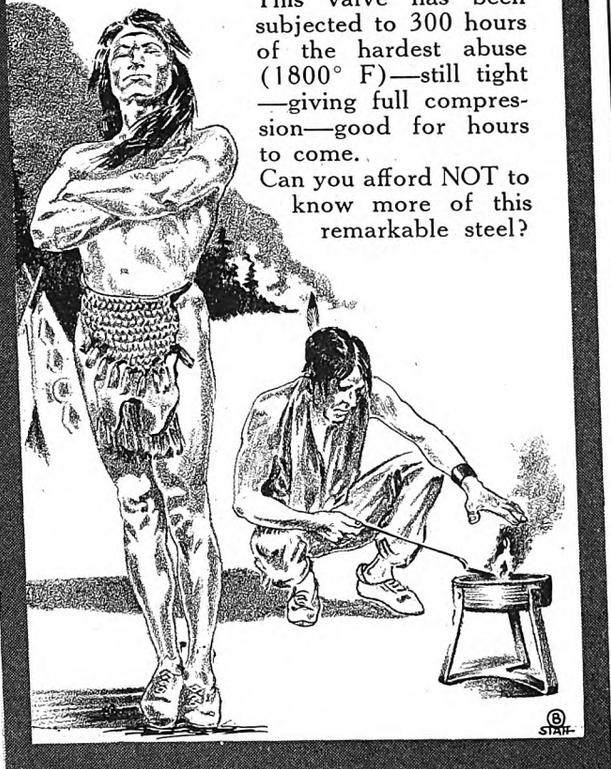
Examples of the stoicism of the Iroquois Indians are almost unbelievable. Self-inflicted tortures established the bravery of these warriors in the eyes of their chiefs, and made them eligible to leadership against the white invaders.

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SILCROME
Valve Steel

has just such amazing, almost unbelievable qualities; it defies abuse and resists excessive temperatures without burning, scaling or warping.
Note the result of tests made with Ludlum Silcrome, Auto Valve Steel and High Silcromium Steel.





This valve has been subjected to 300 hours of the hardest abuse (1800° F)—still tight—giving full compression—good for hours to come.
Can you afford NOT to know more of this remarkable steel?

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SPECIAL PURPOSES
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Meeting Competition by Vertical Combination

(*Continued from page 20*)

veloped vertical trusts in Germany, Italy, France and England. The most complete development exists in Germany, where circumstances combined with the German talent for organization united to create a type of super trust of a stupendous nature.

While in Germany there had been combinations for the manufacture of tin plate and of iron and steel products for a number of years before the war, just as the same thing had grown up to some extent in other European countries and in America, the present organization has assumed economic importance only since the armistice.

During the war every nation discovered the value of pooled resources. Each country had its war industry boards for the control and coördination of industry in the interest of output and efficiency. War driven necessity was the father of consolidation and coöperation among interests which before the war had hated and feared each other and which had practiced destructive competition from their inception.

The state of isolation in which Germany found herself at the close of the war combined with the loss of valuable territories and of important sources of raw materials—especially coal and iron ore and the burden of reparations—all necessitated even closer coöperation among the industries of the country. The promotion of both vertical and horizontal syndicates was further necessitated by the fact that many independent concerns lost, under the treaty, their connections in Alsace Lorraine and Luxemburg.

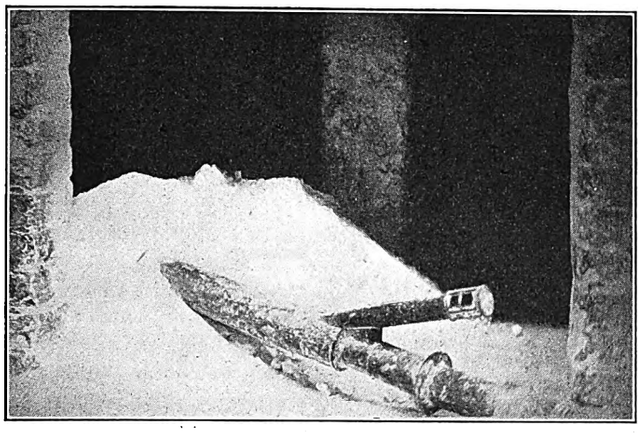
The greatest vertical consolidation, as is natural, has taken place in the mining and steel industries. The thirteen great combines, known as "Konzerns" at present existing are organized as independent and self contained units beginning with the production of iron ore and coal and ending with the manufacture of finished products such as automobiles, locomotives, hardware and various other highly finished products.

These "Konzerns" have combined with manufacture their own land and water transportation systems and have established their own sales offices in Europe and America so that the articles they manufacture are under their own control until they are purchased by the ultimate consumer. The majority of these combines are closely identified with large banking institutions, which permits them to do their financing on the most favorable terms; and a number of them own newspapers, which enables them to mould public opinion in their own favor.

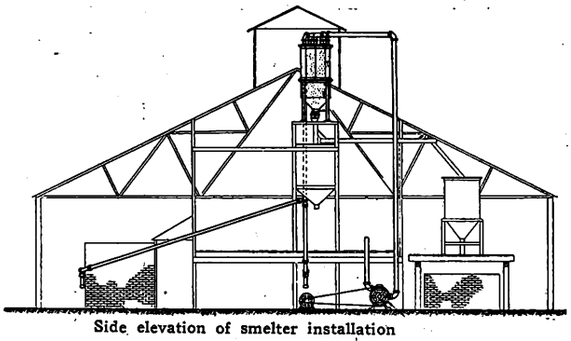
The largest of these is the Stinnes Konzern, a large corporation under a single board of directors known as the Siemens-Rhein-Elbe-Schuckert-Union. In 1923 this comprised 65 iron ore mines, 26 coal mines, 26 blast furnaces, 24 rolling mills, 12 different kinds of steel plants besides automobile plants, transportation companies—rail, river and ocean—and newspapers. It owns electrical plants manufacturing apparatus for signalling, separating metals, purifying the air, drying fish,—turning out cables, wire X-ray machines, microscopes, and building and equipping anything from a subway to a power station.

(*Continued on page 41*)

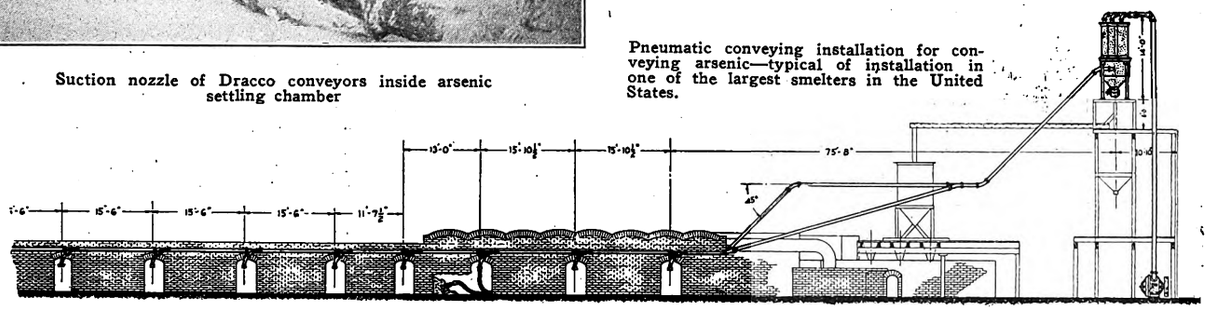
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Suction nozzle of Dracco conveyors inside arsenic settling chamber



Side elevation of smelter installation



Pneumatic conveying installation for conveying arsenic—typical of installation in one of the largest smelters in the United States.

For Example—

DRACCO Pneumatic Conveying Installations in Large Smelters

—where the problem of conveying dangerous or poisonous material is an unusually vital one, Dracco pneumatic conveyors overcome difficulties hitherto considered unsurmountable.

The diagram above covers a concrete case—the conveying of arsenic.

Eliminate Costly Handling Operations that are Highly Injurious to Men

The problem was to eliminate the trouble and lower the expense connected with the removal of arsenic from the settling chambers. Previous to Dracco installation, this was done by shovelling the poisonous material into wheelbarrows and pushing these to elevators that finally lifted the material to storage bin. The operation was costly and injurious to men. Both factors have been done away with by Dracco. If you have a similar problem — or an entirely different one—write our engineering department today for their solution.

We specialize on Fume Recovery, Dust Collecting and Pneumatic Conveying. Let us solve your problem. *We can do it.*

DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.

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"Miss King:—

~A Letter, Please, to The Hinde & Dauch Paper Co.

~~~~~ and a Memo to Our Shipping Department"

And it is just that easy—to get a thoroughly satisfactory answer to the big question: "Is there a better way to pack our products for shipment?"

A letter to us—stating the quantity of boxes usually ordered. A memo or 'phone call to your shipping department asking that a typical shipment be sent to our Free Box Design Service Department. *And that's all.* Without leaving your desk you can get *action* on a matter that may be costing you thousands of dollars annually.

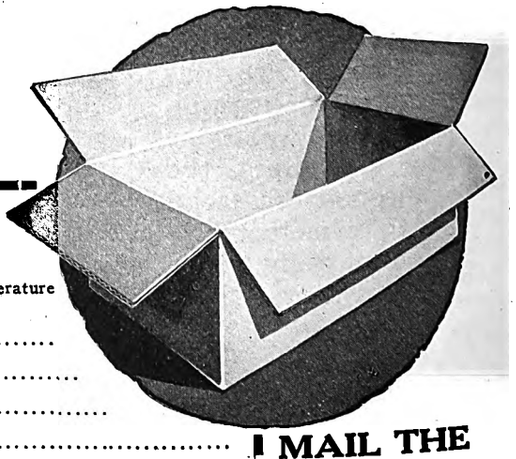
And by accepting our invitation you will not place your firm under the slightest obligation.

The Service Staff of the World's Largest Manufacturers of Corrugated Fibre Shipping Boxes is at the Free Disposal of All Shippers of Merchandise.

If your present box costs are too high—if your transit losses are running heavy—if you want to improve the appearance of your shipments—put the problem up to the H & D Service Department today. Give us full facts in a letter—or better still, send a sample shipment of your goods and let us make up and submit to you a new container built according to H & D specifications. When you receive the H & D Box compare it with your present packing—safety, appearance, cost, convenience—and note the difference.

A letter (or the coupon) to us—a word of instruction to your shipping department—and you will have taken a step toward a better shipping package for your goods.

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We are shippers of .....

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MAIL THE COUPON

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(*Continued from page* 38)

One man described the operation of this vast consolidation roughly as follows:

"The Stinnes Konzern has prepared a secret official directory containing hundreds of pages covered with names of mines and factories, of their directors and of their products. If any Stinnes factory needs a new dynamo or a supply of belting, the director turns to this directory and orders it from another Stinnes plant.

"If Norway places an order for steel rails, iron extracted from Stinnes Alpin-Montan mines in Austria goes to the blast furnaces of the Stinnes Dortmund plants in the Ruhr where Stinnes coal has been dug and coked in a Stinnes oven, the by-products being despatched to another Stinnes plant. On a Stinnes railroad the coke has been carried to Dortmund furnaces and the waste gases are utilized in another Stinnes factory. The pig iron is taken to a Stinnes rolling mill and made into rails. A Stinnes barge then carries these rails down the Rhine to the warehouse of the Hugo Stinnes Commercial and Transport Company in Rotterdam from which a ship of the Hugo Stinnes Corporation of Hamburg carries the rails to Christiania.

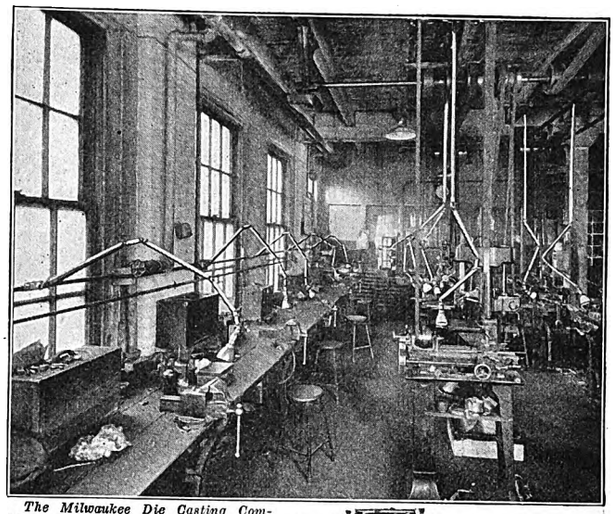
"In this way the Stinnes Konzern keeps the lion's share of the profits—dozens of different profits in the case of a complicated machine—in the family and adds to them by eliminating waste of material, of labor, of sales and administrative expense and of interest on borrowed capital.

"The Stinnes director with the secret official directory in his hands simply telephones his order to another Stinnes firm and enters the debit in his books. His supplies are sent him on a telephonic order, his goods are shipped to Rotterdam on a telephonic order. From the time the iron leaves the mines until the rails are delivered in Norway, not a cent of money needs to pass between the constituent parts of the Konzern. When the goods are paid for in Christiania the Stinnes Commercial and Transport Company pays its bills to the plants which in turn pays the mines. Stinnes capital works day and night.

"Buying and selling are also amalgamated to the greatest possible extent. In the case cited above the Stinnes Commercial and Transport Company which sold the rails would also buy American copper for use in Stinnes locomotives. It can buy more cheaply because it buys in mass and in a way to take every possible advantage of exchange. Since it is continuously both receiving and spending money it can do business with a comparatively small amount of liquid capital."

In securing control of this vast super-trust Stinnes took every advantage of the falling mark and the industrial chaos in central Europe. Some plants he bought, some he secured by the pooling of interest, some he forced to sell out by paying higher wages than his less efficient rivals could meet. Thus three years after the war Stinnes emerged from the industrial chaos of Germany with a supertrust of a range and complexity beyond anything the world has ever before seen.

The A. E. G. (Allgemeine Elektricitäts Gesellschaft)—Rathenau's old company—is nearly as large as Stinnes Konzern. After the war it set itself to acquiring coal and iron in order to insure a supply of raw materials. To these it added other plants. By pooling interests with the Lincke-Hoffman Locomotive and Railroad Car Company which has working agreements with other



The Milwaukee Die Casting Company recently replaced all existing lighting fixtures with an installation of one hundred "American" Adjustable Fixtures with conduit fittings.

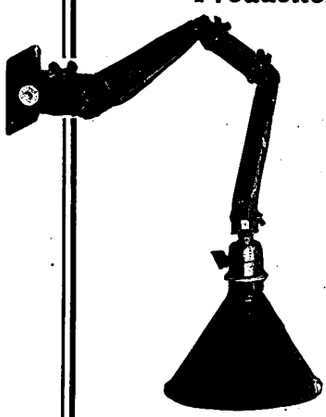


Plenty of Light
Where You Need It Most

—to eliminate all glare and eye-strain, and do away entirely with those costly shadows that are responsible for most of the "rejects" and spoilage.

The operator can easily move his "American" Adjustable Fixture into the exact position to cast an adequate light volume right on the work he's doing. The job is not only better done, but it has taken about one-half of the usual time.

Production is increased from 25% to 65%



The many styles of "American" Fixtures are built to fill all industrial lighting conditions; they're made to fit either conduit or open wiring—approved by the Underwriters' Laboratories.

A new illustrated catalog showing styles and prices is ready to mail. Send for a copy now, before it slips your mind.

American Fixture Company
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If You Intend to Alter or Build

be sure to write for this 32 page book illustrating and describing better floors for workrooms, offices, laboratories, cafeterias, welfare rooms, power plants, etc.

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Jenkins Bros

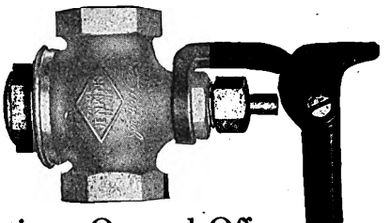


Fig. 720 — Bronze Rapid Action Valve.

For Rapid Action—On and Off

The Jenkins Rapid Action Valve is primarily designed to save time. It also saves water.

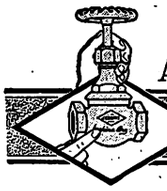
When the operating lever is hanging freely, the valve disc is firmly held to its seat by the heavy phosphor bronze spring and the existing water pressure. A quick upward quarter pull of the lever causes the valve spindle to force the disc off its seat.

A slight pull on the lever, and the valve instantly closes, without water hammer, or any pounding or rumbling in the piping.

Made in sizes ¼ to 2½ inches. Write our nearest office for the "Rapid Action Valve" folder.

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80 White Street.....New York, N. Y.
524 Atlantic Avenue.....Boston, Mass.
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Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

railroad equipment companies it secured control of the largest production organization of this type in Europe. It secured the Deutschewerft—the shipbuilding works of Hamburg—which brought it into advantageous relation with the Hamburg-American Line and with Krupp and Otto Wolff.

Altogether the A. E. G. has no fewer than 872 separate factories and branches. It produces hard and soft coal, iron ore, iron and steel products, electrical equipment of all types, machinery, locomotives and railway equipment, chemicals, glass and porcelain. It promotes and finances transportation and lighting corporations which use its products.

The A. E. G. is one of the most marvelous organizations in the world. It employs hundreds of thousands of men. Every department is organized for efficient operation to the last detail and the men at the head of it possess rare ability. I spent a considerable part of my stay in Germany in 1920 with some of these men—directors, consolidators and engineers—and in studying the plants of the company.[1] We have much to learn from the A. E. G.

The Heneschel, which was a horizontal syndicate of coal mines in 1921, became a vertical trust in 1922 by adding steel plants, chemical plants (Badische Anilin) etc.

The Tietz and Wertheim chains of department stores controlled an enormous share of the retail trade before the war, operating on the principle of cheap buying in large quantities. Since the war two vertical concerns have sprung up in serious opposition—the Karstadt concern which owns seven factories and which is interested in eight more and the Blumenstein concern.

The other konzerns have followed much the same lines. The vertical type of consolidation has been worked out in the pottery industry, the dye industry and along other lines. For the most part these konzerns have been built up along three distinct lines:—

a—Production—in which the subsidiary plants are acquired for the purpose of cheapening production.

b—Merchandizing—in which existing selling organizations desired to insure a supply of products to be sold.

c—Speculative—promoted primarily for the sake of the promoters.

This movement has not been hampered by anti-trust laws because there are no anti trust laws in Germany. However, the tendency has been for the constituent companies in a konzern to maintain a considerable degree of administrative autonomy, declaring their own dividends and managing their own affairs within the limits of their agreements.

These vertical trusts are held together in various ways:

a—Personal Ownership (Stinnes owns only a minor fraction of what he controls. Multiple voting shares are sometimes used.)

b—Fusion or Amalgamation (not common)

c—Ownership of Majority of Stock (not necessary)

d—Holding Company (not common)

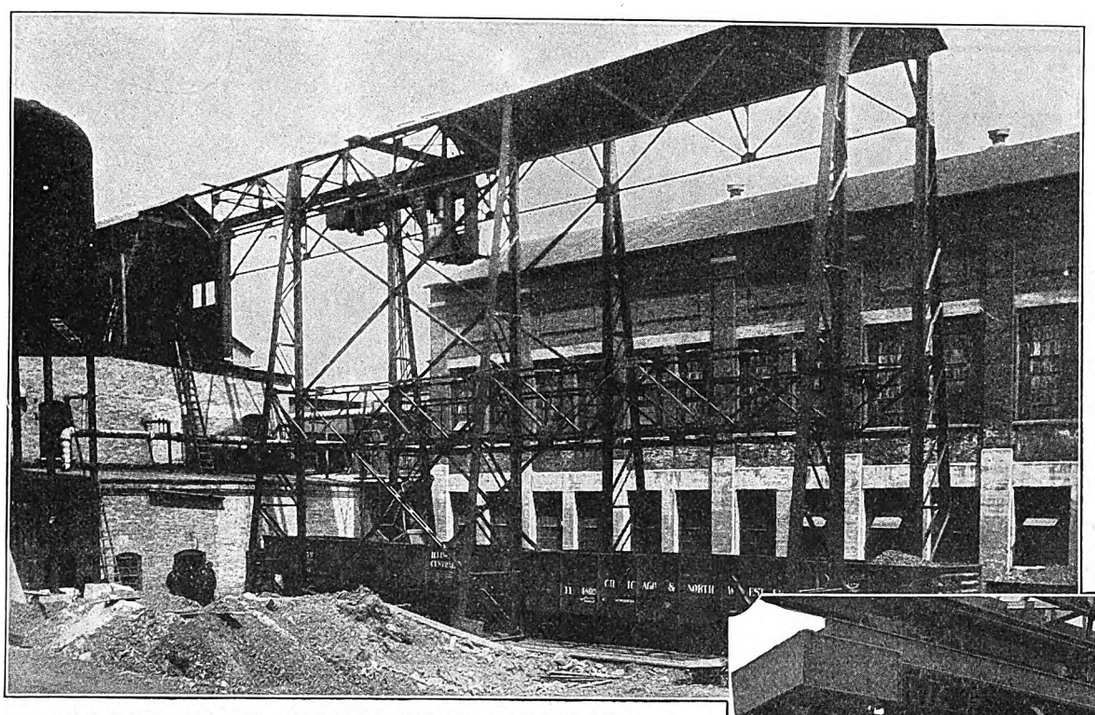
e—Exchange of Shares (common when companies are on an equal footing. Directors are usually exchanged also.)

f—Trade Agreements. (One agrees to supply and the other to take at a fixed price. Does not

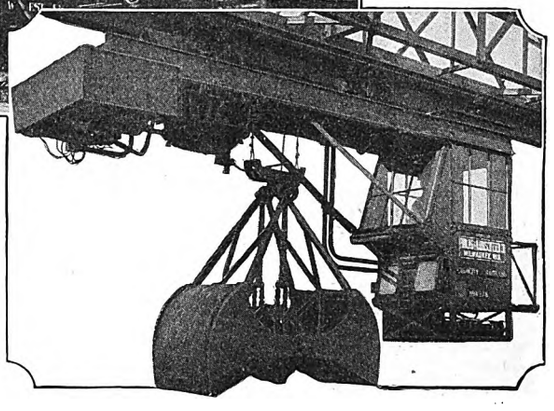
[1]Note—See "America vs. Europe in Industry" for further details.

(*Continued on page* 44)

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P & H 3-Ton Grab Bucket Hoist, Combined Locks Paper Co. The high lift makes rapid hoisting and lowering essential.



The Higher Hoisting Speeds of the P & H—Increases Daily Handling Capacity

In selecting electric grab bucket hoists don't overlook one of the most important factors,—speed of hoisting the bucket. The amount of material handled depends largely upon this speed.

The greater hoisting speed of the P & H Electric Hoist gives you greater hourly capacity, speeds up production, and increases return on your investment. In many cases this higher speed permits using a smaller capacity bucket and hoist for same output as slower hoist.

Grab Bucket Cranes and Hoists because of storage piling height of hoppers or bins, operate at higher elevations than standard cranes making rapid hoisting and lowering essential.

P & H Grab Bucket Cranes and Hoists can give this higher speed service and yet withstand the severe long hour duty of this type of material handling equipment because of the quality of design, material and construction.



Bulletin 305 gives all the details. If you are interested in keeping operating costs down—send for a copy.

Crane and Hoist Division

PAWLING & HARNISCHFEGER CO.

Established in 1884

3850 National Ave., Milwaukee, Wis.

Offices and Agents in Principal Cities

Dynamic Braking

Used on P & H Grab Bucket Cranes and Hoists eliminates wearing of friction surfaces—and gives the operator easy, efficient control of all hoist motors.

P & H Hoists are rightly proportioned to meet grab bucket service requirements. Larger motors that may be used with P & H Hoist construction insure the higher speed.

All parts are accessible.

Cast steel spur gears with cut teeth are used. Hoisting gears run in oil-tight cases with splash lubrication. There are no planetary gears.

Shafts are turned and ground to micrometer size. Bearings are bronze bushed.

The result is long life, *low maintenance costs,* and continuous every day service.

P&H GRAB BUCKET HOISTS

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A Safe Ladder gets the job done quicker and at lower cost



Two Dayton Safety Ladders can be used to form a strong, steady scaffold. The unusual width of the working platform allows the use of a very wide plank, and the strength of the ladders will support any desired load. No need for unwieldy trestles.



This picture shows how the wide leg-spread enables the Dayton Safety Ladder to straddle machinery or other obstructions. A scaffold would usually be required for this job.



Two men can easily work at one time on the platform of a Dayton Safety Ladder — thus bringing four hands to the job with convenience and safety.

You are losing money every day your workmen use old-fashioned ladders around your plant.

Most of them are unsafe—and accidents are costly. Most of them require the services of an extra man to hold the ladder and pass up tools.

Work is slowly done because the workman has to use one hand and all his wits to keep from falling off.

With a Dayton Safety Ladder your workman *feels* safe—and *is* safe. He can devote all his attention to his work. The platform is broad and firm and there is plenty of room for tools. He can work with *both* hands. And no helper is required.

Hundreds of industrial plants which have ordered one Dayton Safety Ladder have subsequently ordered anywhere from six to a hundred. They do save money and prevent accidents.

Write today for our illustrated folder, containing full description, sizes and prices. It will pay you in reduced maintenance costs.

The Dayton Safety Ladder Company

Dayton, Ohio

Dayton Safety Ladder

(*Continued from page* 42)

necessarily involve any financial operation. This is the most common way of holding together the Vertical Trust.)

g—The Selling Corporation. This is related to the old Cartell. There are at least six kinds of Cartells including agreements as to:—

1—Sales terms, credits, etc.
2—Prices
3—Sales (Consolidation, etc.)
4—Outputs (Something like the U. S. blind pool of 1905).
5—Purchases
6—Retail Methods.

h—Pooling of Interests—an extension of the trade agreement principle including perhaps—

1—Common Investment in a third undertaking of mutual value.
2—Formal Contract regulating all the affairs of the contracting firms in their relation to each other—supply—price—production—pooling of profits—Under this last each company manages its own affairs, declares its own dividends, etc. within the limits of the agreement.

Finally these monstrous konzerns are all tied together through the Federal Council of Economics (Reichewirtschaftrat)—which is a parliament of business and is on a par in point of authority with the Reichstag,—and with the German Engineering Society which does special research and standardization work. Back of it all is the Organized Economic System (Planwirtschaft) of Bismark and of Rathenau[2] which ties all industrial Germany—capital, management and labor—into one vast machine for the production of goods at prices to undersell all competitors.

In France the Schneider interests form a vertical trust extending from the mining of coal and ore through shipbuilding and automobile manufacture. The Berliet motor plant at Lyon starts with the blast furnaces and ends by placing the finished car in the hands of the consumer.

In Italy the I. L. V. A. has mines, blast furnaces, electric furnaces, factories for the manufacture of refractories, cement, marine and other engineering works, hydro electrical plants and a steamship company.

In England Lever Brothers cover everything in the line of soap from cocoanut groves and steamship lines through the finished product. Vickers is also tending toward vertical trustification, having certain subsidiaries possessed of coal and iron mines in addition to their steel plants and turning out in their Vickers-Metropolitan finished electrical equipment.

In America Henry Ford is working toward the Vertical Trust in two ways. At present his holdings consist of ore lands in Michigan, coal mines in West Virginia and Kentucky, timber in Michigan, West Virginia and Kentucky, water power plants, coke ovens, blast furnaces, foundries, rolling mills, automobile factories, glass, paint and varnish plants, a railroad, etc. He has entered the banking, newspaper and grocery field, is reported as entering the rubber and textile field and has plants and selling organizations not only all over America but in many of the countries of Europe.

In addition to this direct organization of a Vertical

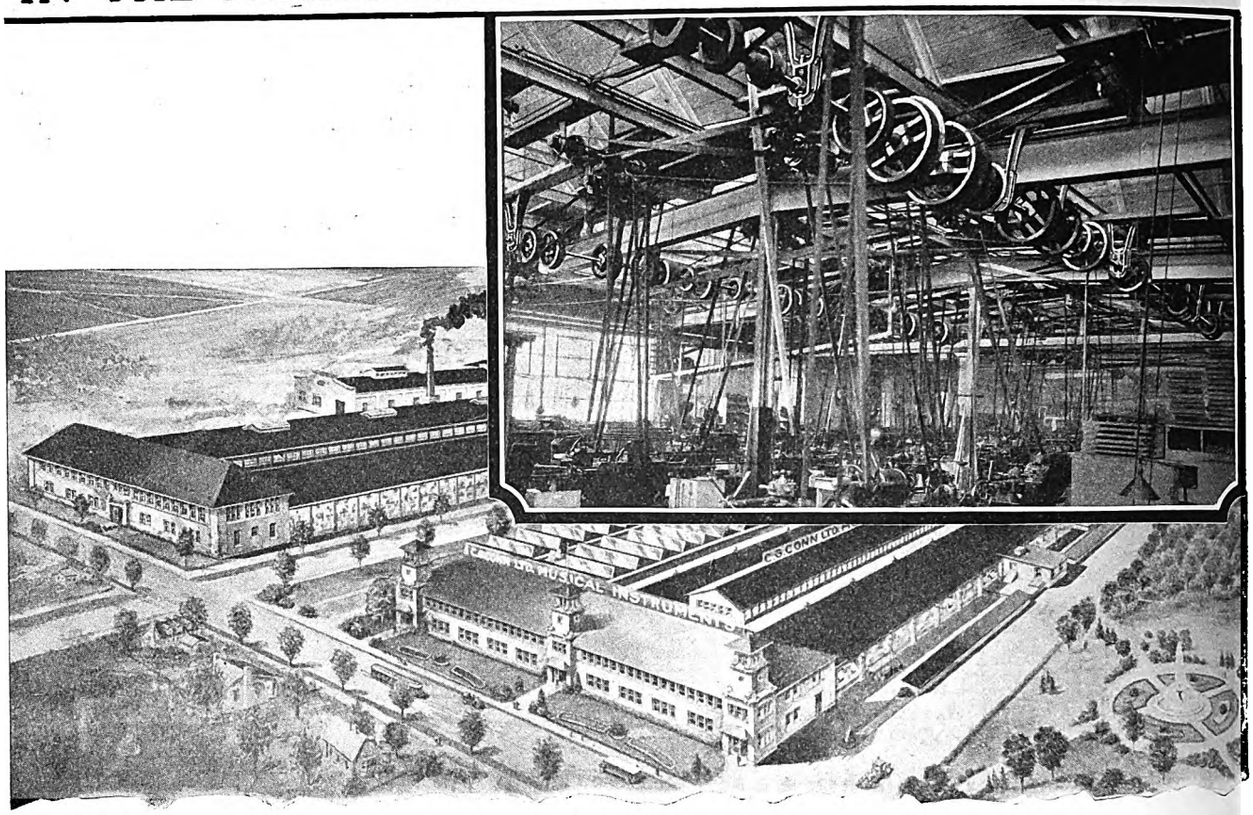
[2]Note—See author's address before the 1922 annual meeting of the Chamber of Commerce of the United States.

(*Continued on page* 47)

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IN THE PLANT OF C. G. CONN LTD. ELKHART, IND.



Dodge Transmits Power to Build Instruments for the Masters

From a tiny workshop, employing one crude lathe improvised from a sewing machine, through three devastating fires, C. G. Conn, Ltd., has grown to the large plant shown above manufacturing band and orchestra instruments. 180,000 feet of floor space is overhung with Dodge Power Transmitting Machinery, including pulleys, hangers clutches, etc.

Conn specifies Dodge Power Transmitting Equipment because Dodge represents to Conn what Conn represents to the master musician.

Dodge means power savings. Three large factory warehouses and fourteen branch warehouses supply 500 local dealers who supply Dodge power transmitting appliances on the immediate delivery basis.

Dodge Units Withstand Fire and Water

Some of the Dodge equipment in use today in the Conn factories went through at least one of the devastating fires which reduced three Conn plants to ruins. Salvaged from the ruins, Dodge hangers, pulleys and shafting were again pressed into service, while Dodge engineers worked tirelessly to assist in re-establishing production schedules.

DODGE

DODGE MANUFACTURING CORPORATION *General Offices:* Mishawaka, Indiana *Works:* Mishawaka, Ind., and Oneida, N. Y.

EVERYTHING FOR THE MECHANICAL TRANSMISSION OF **Power**

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(*Continued from page* 44)

Trust he has for a number of years obtained many of the advantages of this type of organization by his method of financing himself at the expense of his dealers and of the men from whom he has bought raw and semi-processed materials. He has also secured a considerable part of the competitive strength of the Vertical Trust by his method of becoming a manufacturer's only customer and then fixing his own price. Ford's labor methods are similar to Stinnes' and have tended toward the same effect upon rival manufacturers. It has been his instinctive grasp of the advantages of this type of organization that has enabled him to build up a business that turns out about half the automobiles in the country at a price rivals cannot hope to meet.

Durant has adopted a policy "to keep the profits of the business in the family." To that end he has purchased a large glass plant and is reaching out for other plants. His method of financing, in principle, bears a certain resemblance to Ford's plan.

The consolidation of the Simmons Hardware Co. and the Winchester plant is a step toward vertical consolidation. George F. Johnson with his own tanneries, shoe factories and retail stores has an almost perfect vertical trust. His labor methods are somewhat similar to Ford's. As a result he declared dividends while his rivals were still losing money at the time of the last depression. There is a publishing house in Kentucky which owns forests, pulp mills and type foundries in addition to its regular printing plant. It is putting well printed books on the market through Woolworth. Schwab's activities in acquiring mines and motor plants are steps in vertical integration. A large silk company has formed an almost complete vertical trust and there are other examples in increasing numbers.

While there have been serious doubts cast upon the advantages of consolidation by economists and while there have undoubtedly been disastrous failures, these have, for the most part, been due to the consolidation of industries which were not fit subjects for consolidation from an economic standpoint or to weakness in the human element involved. The presence of a well developed acquisitive instinct does not necessarily imply executive ability on a large scale and a man who has made a million "by his own efforts" has sometimes traded open-mindedness for egoism.

Where conditions and personnel are favorable however, vertical consolidation—

1—Insures a lower cost of manufacture through the continuous quantity production of standardized articles.

2—Saves expense through consolidation of administrative, sales, advertising, insurance, etc., departments. Sells only to ultimate consumer.

3—Saves transportation charges on raw material and finished product, (especially where a certain amount of horizontal consolidation is combined with the vertical).

4—Provides for pooling of knowledge, methods and processes.

5—Assures a uniform quality and low cost of raw materials.

6—Makes maintenance of superior quality possible.

7—Reduces interest and depreciation on stores of

(*Continued on page* 49)



Flange Coupling. Pressed on shaft ends and faced to insure accurate alignment.



Drop Hanger. Double brace, four-way adjustment, with either ring, collar, wick or plain oiling bearings.

LARGE STOCKS



Package Car Service

Large stocks of regular sizes of turned and polished steel shafting, couplings, collars, hangers, bearings, split wood pulleys, take-ups and other standard transmission appliances are available for immediate shipment from our plant at St. Louis and our warehouse at Cincinnati.

MEDART

Everything in Line Shafting Equipment

Our plant connects directly over its own tracks and switches to 26 railroads offering package car service in every direction.

Your open orders either for stock or made-to-order products will be invoiced according to our discount-sheet applicable to Medart catalog number 43, which you should have on file.

Send your next order, whatever your transmission needs, to

THE MEDART COMPANY

(Formerly Medart Patent Pulley Co.)

General Offices and Works, St. Louis, U. S. A.

Offices in Chicago, Philadelphia, Pittsburgh and New York
Office and Warehouse in Cincinnati

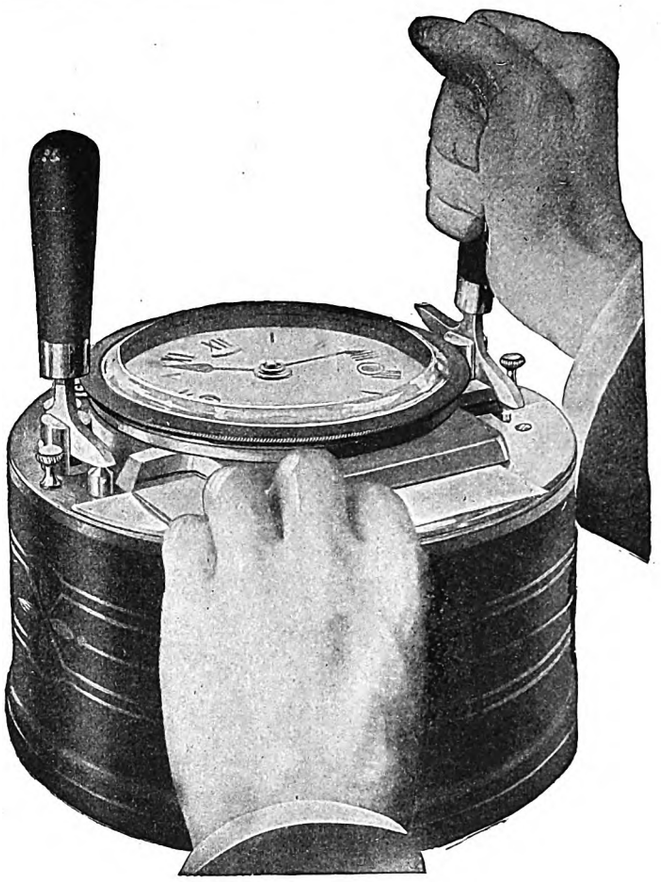


Cast-Iron Pulley. Sizes range from 3-in. to 150-in. diameter, and up to 50-in. face.



Gearing. Whatever your needs, we can supply them. Gears cut to 72-in. diameter.

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The Man with the Pencil Didn't Mean to Blunder

MOST of your factory folk are not wilfully dishonest, but they're apt to be negligent and sometimes careless. Give them a time card and pencil, and at the end of a year try to figure your losses from inaccurate records. You will find it a complex business, with losses larger than you had supposed.

The Calculagraph wipes away these blunders—stamps on the time cards the exact time of beginning and ending each job, together with an *automatically printed total of the time elapsed.*

A complete description of the machine and its application in manufacturing plants will be sent you *free on request.* Ask for booklet, "Elapsed Time Records."

The Calculagraph Company

34 Church Street **New York**

THE CALCULAGRAPH

THE ELAPSED TIME RECORDER

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(*Continued from page 47*)

raw material and semi-finished and finished products.

8—Reduces amount of capital required per unit produced. No money passes until consumer pays.

9—Increases ease of financing—securities are more liquid and more stable.

10—Permits use of research laboratories—and all that that implies.

11—Increases security of patents and trade marks.

12—Permits securing highest class of administrators and executives.

13—Permits retention of highest class of staff experts—lawyers—engineers—chemists, etc.

14—Makes the most effective type of administrative methods possible.

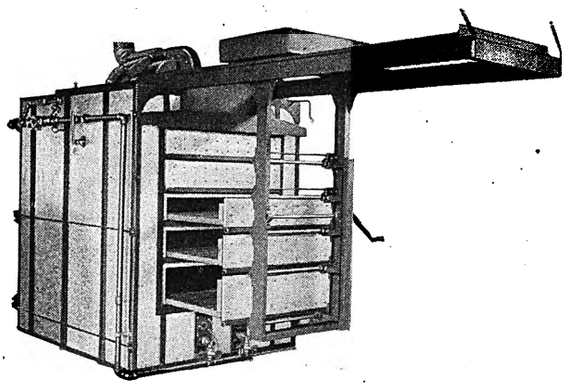
15—Places the industry in a strategic position of great strength.

Where properly organized, the advantages of vertical consolidation are undoubtedly very great. The strength for competition secured by horizontal consolidation was so great that its abuse led to the passage of the Sherman Anti-Trust law. A concern that now controls over forty per cent. of the market for a given product is subject to severe scrutiny by the Federal Government. To date ways and means of preventing cut-throat competition have managed to keep a lap ahead of the attorney general as every big business man knows. The distinction between a trade association for the public good and one which operates in restraint of competition is being determined daily in our courts. As long as human nature persists however it will be increasingly difficult to keep the president of the trust controlling forty per cent. of the market and the leader of the independents from playing golf together. As competition from European vertical trusts is felt more and more keenly in our markets it is a question whether the present Federal law will not find increasing difficulty in combating the law of self preservation.

In certain instances it has already been necessary to loosen the bonds. Some years ago the German copper buyers formed a trust and were able to play one American producer against another so as to force down prices below those which American buyers could secure. This helped the German manufacturers to undersell Americans in world markets. As a result legislation was enacted permitting combinations for export trade of a character unlawful in the domestic trade. There is still a weak link in the armor, however, since there are combinations as we have seen in a number of foreign countries which fix the prices of raw materials and finished products which are bought by this country. American buyers have in a few instances combined—as in the case of the department stores. There is, nevertheless, a considerable field which is yet untouched and which has possibilities for the development of buyers' cartells.

The legal phase of the question is an interesting one but is too vast for discussion at this time. The extent to which the Federal Government interferes with vertical consolidation will depend quite probably upon the reasonableness of the men who head them. Personally I believe that the vertical trust is more likely to injure the horizontal trust and its inefficient rivals than it is to injure the public. Certainly Ford and Johnson have made motor cars and shoes much cheaper and have so been of vast benefit to the public.

The consolidation of allied industries has undoubtedly



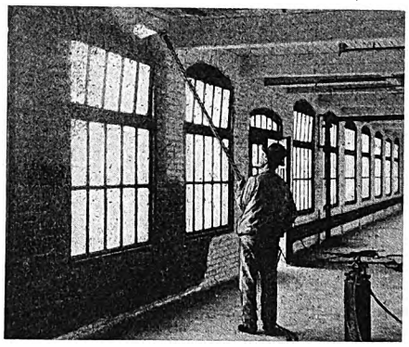
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MAEHLER principles of construction, heating, ventilation, and temperature meets every core oven requirement.
Maehler insulation keeps the heat inside the oven properly circulated and automatically controlled. Rejection losses and fuel costs are low.

Give us a description of the oven you need, capacity, size of cores and the space it can occupy in the plant and let us show you how a Maehler Oven will save fuel, increase production, and lower costs of core baking.

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INDUSTRIAL OVEN BUILDERS
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Save 50%-85% on Labor Costs alone. Spraco Pneumatic Portable Painting Equipment requires fewer men, takes much less time and does far superior work in every way.

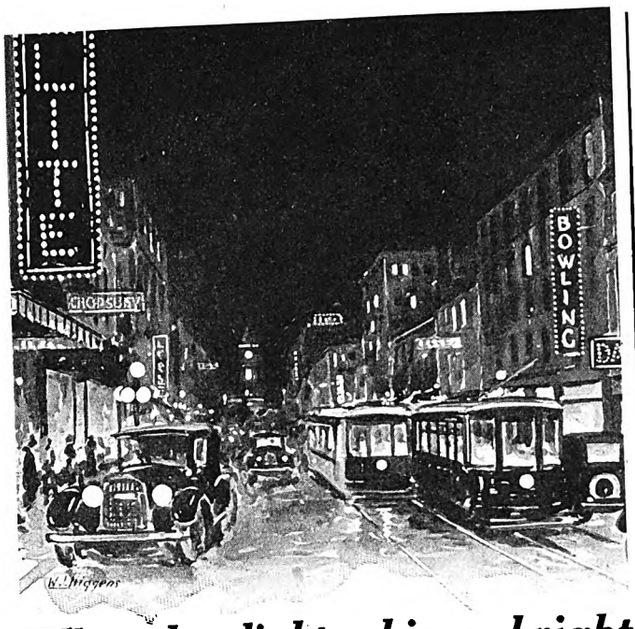
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SPRACO BOSTON

Repaint your Plant the "SPRACO" Way

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Why the light shines bright tonight along "Main Street"

THE light shines bright tonight on your town's Main Street largely because mechanical stokers in the power house are on the job.

The stokers were probably placed there during recent years—were placed there because the use of more electricity had called for more steam to turn generators, more heat to make steam—more heat than could be produced in old fashioned boiler furnaces fired by hand.

And the stokers were placed there by men whose business is selling power—and therefore making it at the lowest possible cost. They were placed there because these men knew that hand fired furnaces wasted their chief raw material—coal. The cost of these stokers had to be justified by operating economies—coal and labor saved!

Can any manufacturer who uses steam afford to overlook the example of men who have made power cost a lifetime study? Is not coal just as definitely a part of every product as the materials used directly in its manufacture?

There is a type of mechanical stoker for plants of every size—a stoker that will pay large returns on the moderate investment it involves. The manufacturer of that stoker has more to sell than an automatic machine for firing furnaces, he has engineering counsel to offer, the product of specialization in the great cost-cutting field of scientific combustion.

Why coal should be your fuel and why a stoker fired furnace is the way to fire it, is told in an interesting book, "Coal—the Basic Fuel." The facts presented in the pages of this book may save you thousands of dollars annually. The book is *free*. Just write to the secretary.

STOKER MANUFACTURERS ASSOCIATION

Ten cars of coal—or nine?

Mechanical stokers save coal by increasing furnace efficiency. They also make it possible to burn cheaper grades and sizes of local coal. Ten per cent saving is a conservative estimate.

Five men or three?

Stoker firing will cross at least two men off the pay roll if adopted by a hand fired plant now requiring five men. The better working conditions appeal to a better, steadier class of men.

Four boilers or three?

Greater steam demands can be met without adding to your present boiler equipment. Three boilers can be made to do the work of four through the higher combustion rate made possible by—

STOKER FIRING

This Book FREE



BURN COAL

STOKER MANUFACTURERS ASS'N

G. A. Sacchi, Secretary, Lester Branch, Philadelphia

worked in both ways. With this type of consolidation it has been possible to cut prices below cost in one branch of the business while making money in several others. This has permitted an aggressive concern to force one rival after another to the wall while still maintaining satisfactory earnings for the company as a whole. Just what happens when the concern is master of the field depends again upon the reasonableness and vision of those in control.

Vertical consolidation requires much more careful preliminary analysis of the situation and of the properties to be consolidated than does horizontal consolidation. In the latter case an appraisal of fixed assets, certified and consolidated balance sheets presenting proof of satisfactory financial condition and of earning power in the past of a sufficient number of concerns of a nature subject to effective consolidation are all that have usually been considered necessary aside from the requisite business diplomacy and financial backing.

Of course, if a business is of a speculative nature which permits of little increase in operating efficiency through horizontal consolidation or if a consolidation is subject to attack by a consolidation of allied industries or by a vertical trust, or if it in some other way violates the fundamental axioms which experience in horizontal consolidation have established, such a consolidation will not realize the profits which its promoters predicted.

On the other hand it is possible to form a horizontal industrial consolidation which later develops a number of weak component parts without serious hazard to the success of the enterprise as a whole. If certain factories prove inefficient they can be closed down and the product turned out more cheaply in the more efficient plants. In some cases plants have been included in a consolidation with the avowed purpose of discontinuing their operation and the consolidation as a whole is in a better condition when this has been done.

The vertical trust, however, is like a building. Each unit is superimposed upon the one below it and the structure as a whole is no stronger than its foundation nor than its weakest story. Great care must be exercised to insure a stable and well balanced structure. It would be folly to place an automobile plant which would take half the output of a steel mill on top of such a mill and operate it at half capacity. It would be equally disadvantageous to place an automobile sales organization capable of selling a hundred thousand cars per year above a plant which could turn out only fifty thousand cars.

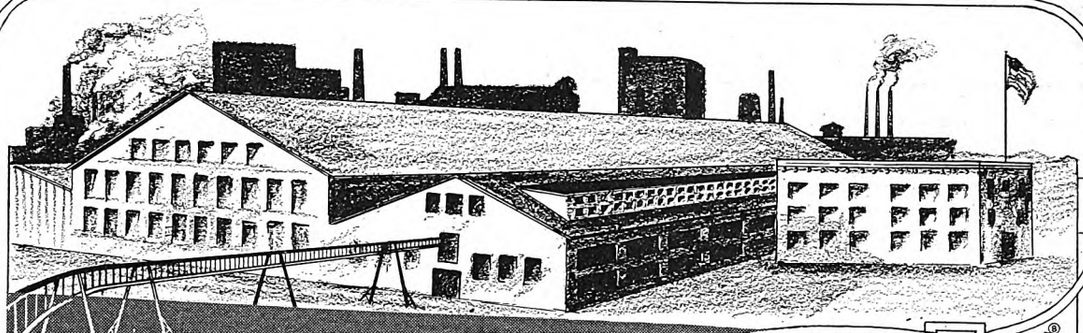
Very often plants in themselves are unbalanced. There are steel mills which could turn out twice their output by building a few more open hearths without increasing their investment in previous or subsequent departments. There are a great many plants which could turn out from 25 to 50 per cent. more product if they were efficiently managed.

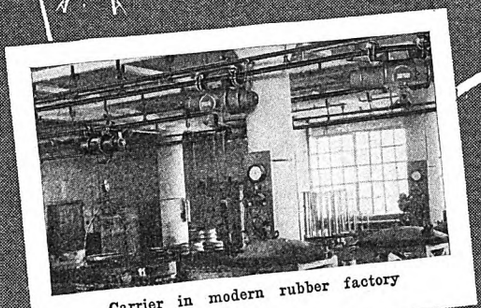
To secure, therefore, a well balanced, self-sufficient vertical trust it is necessary to make a very careful survey of the plants to be consolidated and to determine from an engineering standpoint their actual and potential capacities before attempting to erect such a vertical structure as we have described.

Steps must be taken to insure effective management of each plant in the structure. Vickers' attempts to insure this by making each plant manager meet bids from outside concerns in both quality and cost. The disastrous

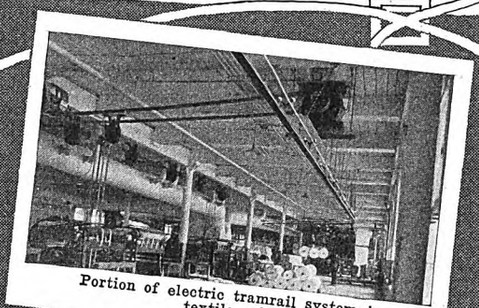
(*Continued on page* 52)

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Carrier in modern rubber factory



Portion of electric tramrail system in textile mill

The Cleveland Tramrail is the most flexible, most adaptable carrier system ever devised.

Absolutely universal in character—can be operated to all parts of a building, to any specific spot in a plant, upstairs, out of doors, on elevators, around curves, right angle switches, etc.

Why not talk over your problems with one of our engineers? He will gladly call.



Complete floor coverage for bale storage showing electric cab



Heavy crates readily moved by hand power carrier and special box grab

CLEVELAND HAND OR ELECTRIC TRAMRAILS

CLEVELAND ELECTRIC TRAMRAIL
Built by
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO.

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INSTANT MAN FINDER

Finds Wanted Men in 30 Seconds

IN establishments not equipped with a good Call System almost every man-hunt ties up inter-department telephone lines, besides wasting the valuable time of some employee in every department telephoned.

The National Electric Calling System finds the man almost instantly—no one's time is wasted. Code signals sound simultaneously in all parts of buildings or yards. The man wanted hears his code number and gets in touch over the nearest department telephone.

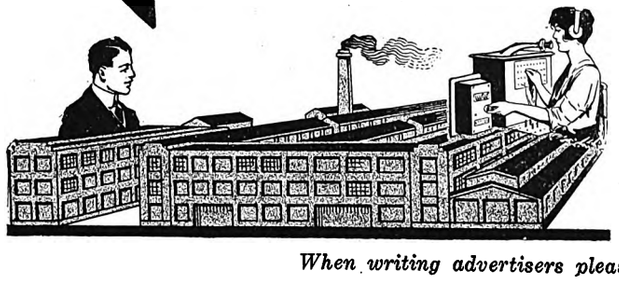
If you have a poor Call System, or none at all, you can stop a costly leak by making a very moderate investment in a reliable National Calling System.

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NATIONAL COUNTING & WEIGHING MACHINES, NATIONAL CALLING SYSTEM, NATIONAL "MULTI-UNIT" STEEL SHELVING, NATIONAL ROCKER-LIFT ELEVATING AND SCALE-ELEVATING TRUCKS.

A touch on the levers—a turn of the dial—and—He's Found!!



(*Continued from page* 50)

effect of having several plants in such a structure which could not meet this test can readily be imagined. It is therefore necessary to make sure that each plant added to a vertical consolidation either is, or can be made, as efficient as any of its rivals, if maximum strength is to be secured for the structure as a whole.

A survey of the market and of marketing methods is almost as essential as the plant survey if over capitalization through acquiring plants and sales organizations which later prove superfluous is to be avoided.

In the past, far too many horizontal consolidations have been made for the sake of the promotion profits. More careful analytical surveys of the physical assets by men who understand marketing, production, and business economics as well as finance would have prevented some of our most spectacular failures.

The danger of failure in the case of vertical consolidation is even greater unless a careful and complete survey is made. A vertical structure composed of inefficient and moribund concerns is more dangerous than these structures uncombined unless a careful enough examination of each is made beforehand to make it possible to predict with reasonable certainty the effect of such a combination from the standpoint of production, sales and finance.

There are a great many features of the German methods of vertical consolidation which can be used to advantage in this country with due allowance for differences in law and in racial psychology. It is, however, obviously impossible to enter here upon such a detailed discussion as a consideration of such matters would require.

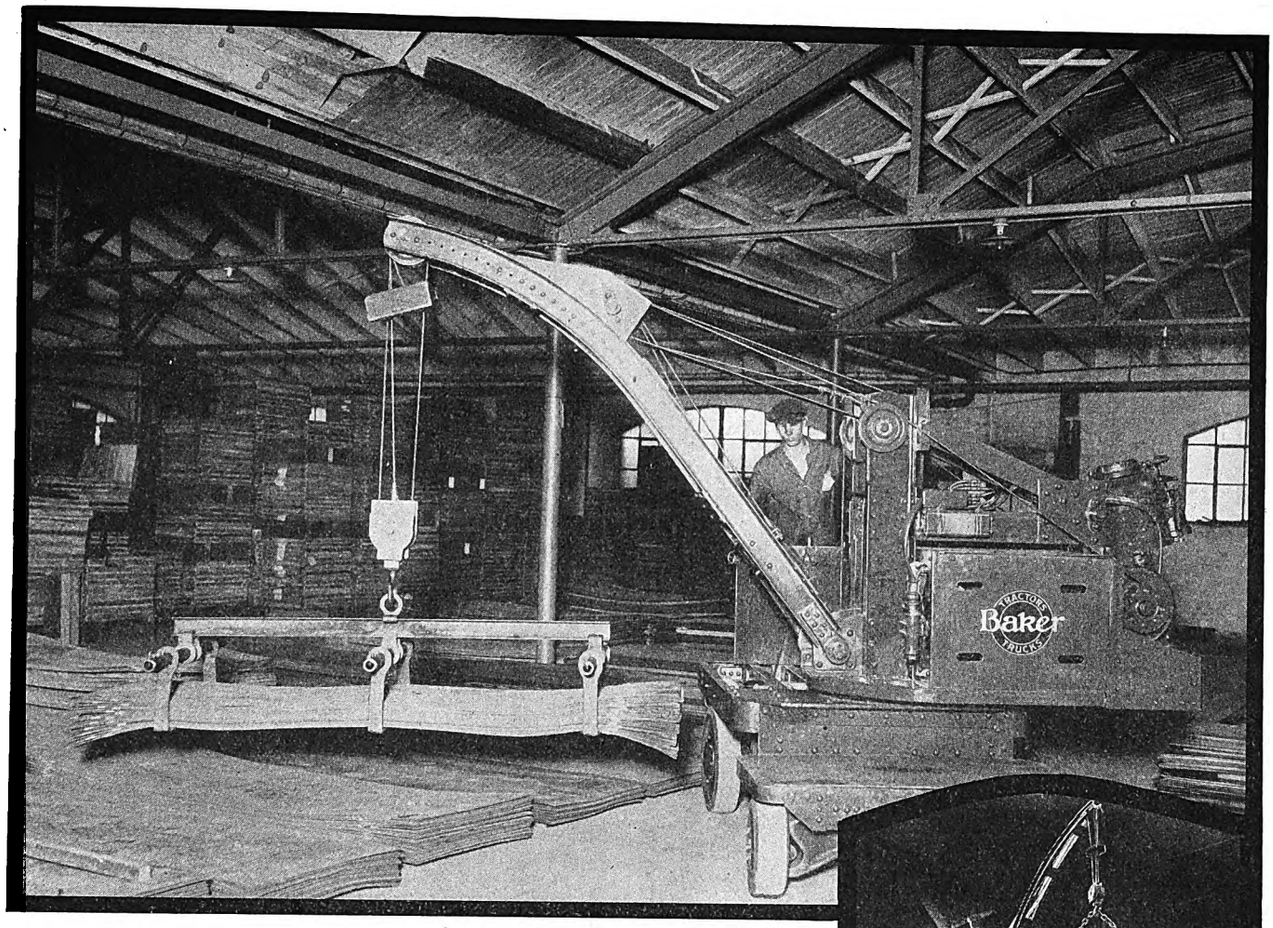
In addition there is a very definite procedure in affecting consolidation from a diplomatic standpoint. A great many consolidations have died a violent and stormy death after months of negotiation just as they seemed about to be born. The various manufacturers involved in one of our largest consolidations vainly tried to get together for three years. Eventually they put themselves in the hands of a man experienced in effecting consolidations and were combined in less than ninety days.

The vertical trust is already with us. Already our captains of industry of greatest vision—Schwab, Ford, Johnson, and a few others not so well known, have realized its possibilities. We are in competition with the vertical trusts of Europe in world markets. We may deplore its arrival but in the face of present competition it is too profitable and too necessary to long remain an innovation in America.

OUTSTANDING manufacturing problems will be considered at the forthcoming annual meeting of the Chamber of Commerce of the United States at Cleveland, May 6 to 8. A special group meeting of leading manufacturers from all over the country will be held on the opening day of the convention, under the auspices of the Chamber's Department of Manufacture, of which E. W. McCullough is manager.

This special group meeting will be devoted almost entirely to problems of particular interest to manufacturers. Discussion of the three major topics of the convention, "Business and Agriculture," "European Readjustment," and "The Responsibility and Integrity of Business" will take place in the general sessions.

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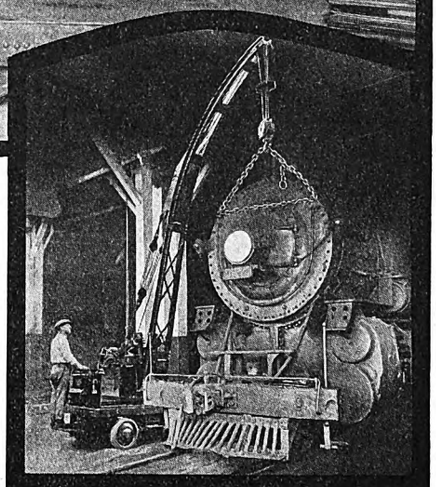
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Suitable for loading railroad cars, lifting heavy parts, carrying sheet steel, pipe or bar stock can be furnished for operation inside a box car or with boom long enough for erecting jobs and locomotive trimming.

3000-lb. capacity at 7 ft. radius. Travel speed 3 to 4 miles per hour. All motions electrically driven by three separate motors. Standard boom, 12 ft. Booms from 8 to 19 ft. supplied on specification.

Baker Industrial Division

THE BAKER R & L COMPANY, CLEVELAND, OHIO



EQUIPPED with the 19 ft. boom, the Baker Locomotive-Type Crane is especially valuable in assembling, erecting or dismantling large machinery.

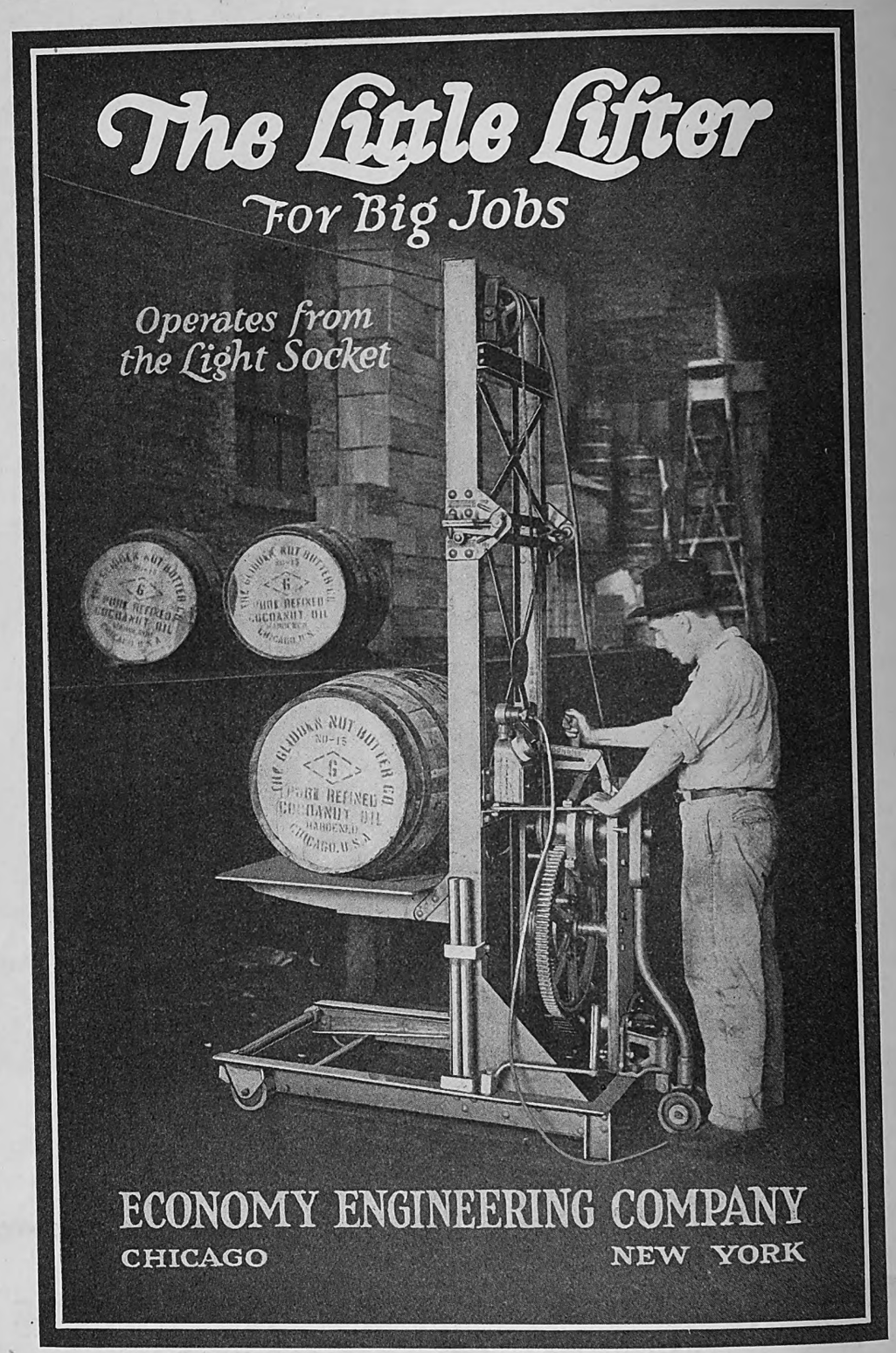
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Keeping the Gear Teeth Quiet

(*Continued from page* 23)

or screw mechanism, or their combinations, which serve to transmit motion. We are chiefly concerned, however, in the average industrial plant with toothed wheels of various designs. Chain drives and friction wheels will therefore not be treated at this time, but will be reserved for individual discussion later, especially on account of the important part which the silent chain drive plays in the expediting of modern plant production today.

Industrial gears will usually be circular, rotating around a common axis with the shaft or cylinder on which they are attached or cut. On the other hand, it is quite possible to extend this principle of the transmission of motion to conical surfaces as well. Individually, they are known as spur, bevel, spiral, annular and worm gearing, according to the manner in which their teeth are cut and the direction in which their motion is to be transmitted. The principle of the gear tooth is also further extended to what is known as the rack and pinion. This includes a flat surface on which gear teeth are cut, these latter meshing with a worm or spur gear (pinion) to bring about reciprocating motion.

Spur gears are those which consist of a cylinder, wheel or disc on the surface of which are cut parallel teeth. Gears of this nature are commonly used to transmit motion from one parallel shaft to another, in either the opposite or the same direction according to the number of gears involved. An intermediate spur gear when located between the two primary gears will serve to bring about the same direction of motion in the driven gear as is developed by the driver. When three gears are involved as above, the size of the intermediate element has no bearing upon the speed attained by the driven gear.

Spur gears are commonly used on industrial machines, working under ordinary conditions, at moderate speeds and with medium pressures exerted upon the teeth. They may be built either encased or exposed, according to the nature of their service and the extent to which they require guarding, or protection against abrasive matter or dust. When exposed, spur gears may often involve lubrication difficulties. Normally they will require a lubricant which will adhere tenaciously to the teeth, capable of withstanding the effects of centrifugal force, speed and temperature changes. Where tooth pressures are not abnormal and the teeth are not subjected to heavy shocks, there is no necessity for the use of a relatively high viscosity lubricant. In fact, too heavy a gear compound will defeat certain of the advantages of lubrication by imposing more or less drag on the gears, thereby increasing their power consumption. As tooth pressures increase, however, the viscosity of the lubricant should be somewhat higher in order to insure that the film on the teeth will be able to resist the cutting and squeezing action especially when sliding motion takes place.

Bevel gears are those whose teeth are cut on an angular surface such as a truncated cone would represent. They are used for the transmission of motion between shafts, the center lines of which intersect, or form an angle between each other. Usually the shafts are commonly located at direct right angles with respect to one another; the gears being known as angle gears. Where two bevel gears are of the same size and their speed

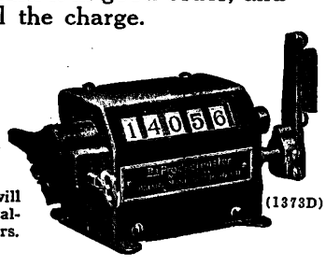
They are human beings

You can't drive your workmen, but man's natural pride in work well done spurs him on unconsciously, if he can see progress.

The Productimeter
The Speedometer of Industry

Breaking records is a game every mother's son enjoys. Put a Productimeter where it shows the record, and the man on that machine will be keyed up to breaking his own record.

Try one at our risk. The effect is noticeable the very first day. But if in 30 days you don't think it worth the cost, return it in good order, and we'll cancel the charge.



(1373D)

Our catalog will give you some valuable pointers. Write for it.

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Quickfix

48 Hour Concrete Floor Patcher

QUICKFIX makes a concrete patch of flint-like hardness, ready for traffic *in only 48 hours.* Ordinary concrete patches block traffic and delay production for ten to twenty days while they harden. *With QUICKFIX you can patch the floor Saturday and open it up to traffic Monday.* Any handy man can use it. No costly delays or interference with plant's operation.

Patch those holes *now*—before they get larger. Don't run the risks of injuring workmen, damaging valuable materials, and slowing up production. Use QUICKFIX and eliminate the danger spots quickly. Send for our QUICKFIX BOOKLET with full details. Show your organization what efficient maintenance means.

SANISEAL—Gives any dusting, crumbling concrete floor, old or new, a wear-proof, dust-proof surface. Get our SANISEAL BOOKLET. SANISEAL without SHUTDOWN.

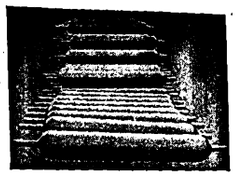
The Master Builders Company
CLEVELAND, OHIO
Factories: Cleveland & Irvington
Sales Offices in Ninety Cities

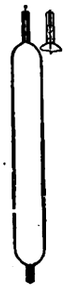
THE MASTER BUILDERS COMPANY
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Quickfix--for making permanent wear-proof concrete patches in 48 hours. We have _____ Sq. Ft. to repair.
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Maintain Your Floors Without Interrupting Production

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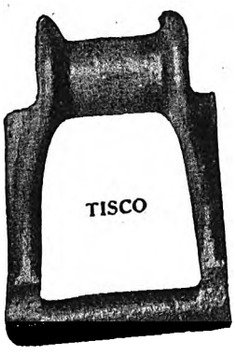
Cross-section showing Hollow construction

SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Made in one piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained where strain is most severe. Yet, because they are hollow, they are light in weight—saving in freight—easy to handle—power cost reduced. Built on order to meet requirements.

Wm. Wharton, Jr. & Co., Inc.
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Cylinders for high pressure gases, Seamless steel tubing, special trackwork for Steam and Electric Railroads.





TISCO MANGANESE STEEL CHAIN

Compare the condition of these two links placed in the same line of chain at the same time—one of Tisco Manganese Steel No. 103 Chain and the other of malleable chain. Manganese Chains usually last from five to fifteen times as long as malleable chains. Wherever equipment is subjected to hard wear or handles gritty materials, Tisco Manganese Steel will give greatest service.

Taylor-Wharton Iron & Steel Co.,
30 Church St., New York City

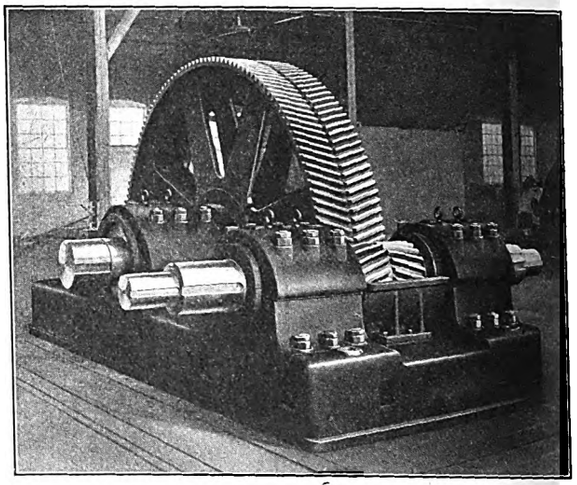
Chain and sprockets — Dipper teeth — Liners for ball mills — Mantles and concaves for crushers—Jaws for jaw crushers.

Bulletins covering the products of the several companies will be sent on request.

ratio remains the same, they are called miter gears. Where of unequal size, they are termed angle reduction gears.

Under ordinary operation, bevel gears will differ but little in their lubrication requirements from spur gears. They will, however, involve the possibility of considerably more sliding motion, with consequently less rolling motion, than spur gears, due to the greater difficulties entailed in cutting perfect teeth and lining up the respective shafts. Therefore it is usually considered advisable to use a somewhat heavier gear lubricant in order to insure a sufficient film on the teeth to resist this sliding action.

Our third broad gear classification includes the spiral, helical gear, or "herringbone" gear. In gears of this type, the teeth are cut on an angle or in helical form in order to gain added strength and greater smoothness



Replacement of large gears, such as these, is expensive whereas proper lubrication is a cheap form of insurance.

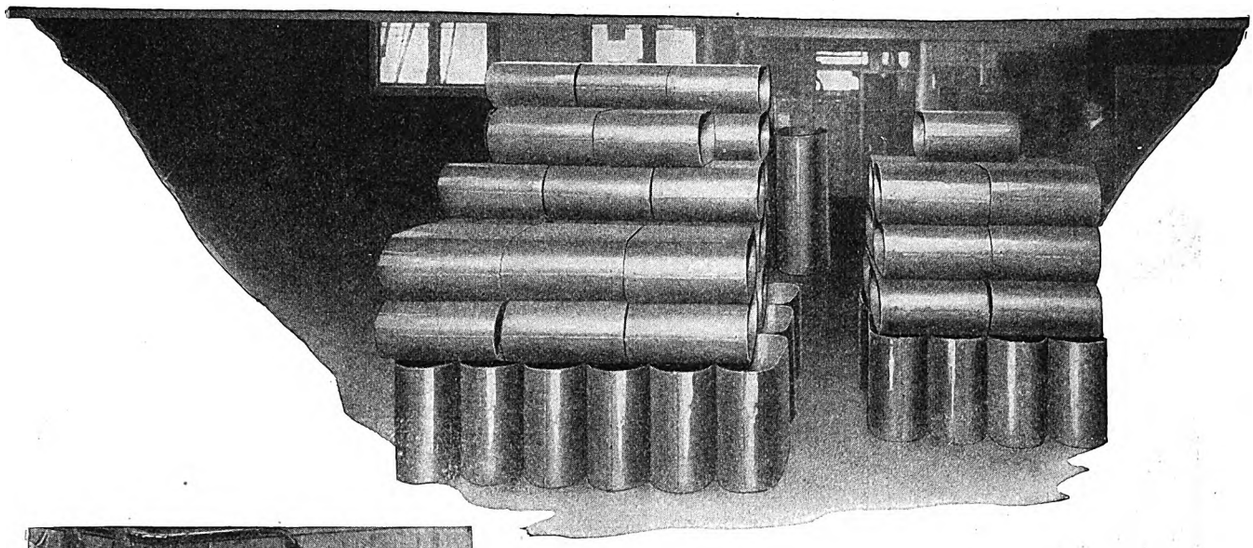
of action than would be possible with spur gears. The teeth of the herringbone gear are cut to slope in opposite directions in order to eliminate end thrust. Therefore, gears of this nature are advantageous for reduction purposes where end thrust along the shafts must be eliminated as much as possible. A further advantage is that wear occurs in such a way as to develop a minimum of sliding friction.

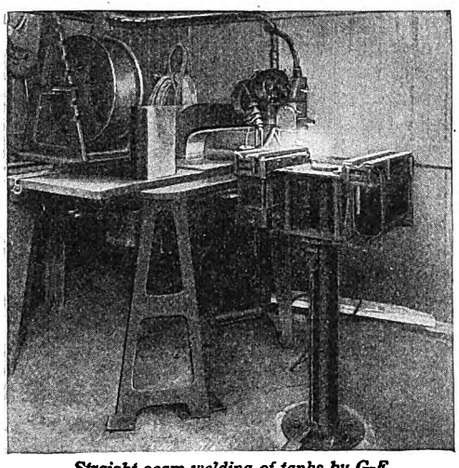
In general, the principal function of the lubricant on a spiral or herringbone gear is to overcome vibration. Vibration or rattling in gears of this type is often claimed to cause pitting along the pitch line, especially where the gears have not been extremely carefully cut or if they are not properly lined up. Pitting is cumulative to the extent that metallic scale may often be developed and broken off with a consequent alteration of the pitch line and rounding off of the corners of the teeth. As a result, such gears are often run in a bath of relatively fluid lubricant to insure maximum protection.

Annular gears or internal gears, have parallel teeth similar to the spur gear, but cut on the inside rim or inner surface of the cylinder or ring. The companion pinion of an annular gear, however, must be a standard spur gear. Annular gearing is often used for large reductions where the direction of motion is to be frequently reversed. The main driving element on certain types of tractors is a typical example of the employment of gears of this type. Lubrication of annular gearing

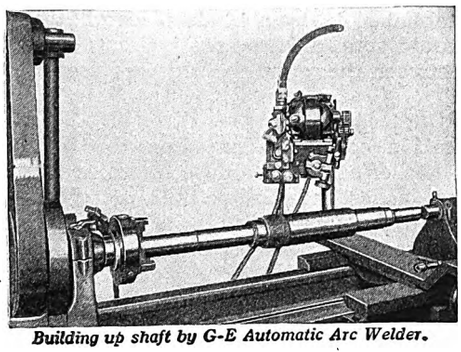
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Straight seam welding of tanks by G-E Automatic Arc Welder.



Building up shaft by G-E Automatic Arc Welder.

Automatic Arc Welding

The above picture shows 50 tanks welded by a G-E Automatic Arc Welder in a half day, as compared to 21 tanks welded by the hand method in a full day. The metal welded is 1/8″ thick by 24″ long.

Through this automatic application of the electric arc, a steadiness of the electrical conditions in the arc is obtained and maintained, resulting in a uniform and high quality of weld—and higher speed. Higher welding speeds produce lower welding costs.

The principal field for the G-E Automatic Arc Welder is the production, by welding, of duplicate objects in considerable quantities.

Its greatest use is for straight line seam, which is the simplest form of weld—but it also does efficient welding of circular seams, and in building up processes on metal.

G-E welding engineers will cooperate with you in making suitable applications of the Automatic Arc Welder to processes of production in your plant. Ask them.

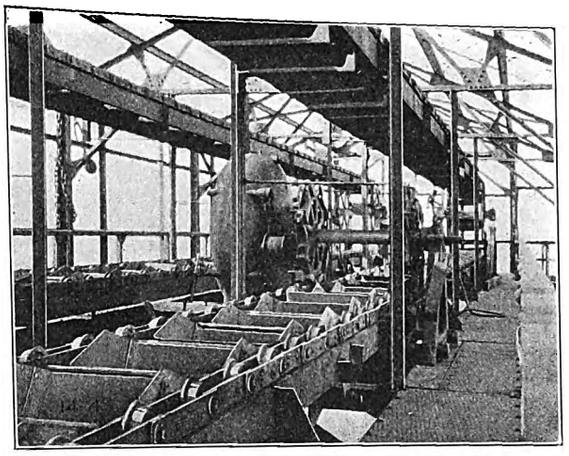
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How Careless Figuring Brings Loss



The illustration above shows a double run of Hunt Pivoted Bucket Conveyors handling coal in a Middle Western City.

Like all Hunt Conveyors this is pawl driven. This method of driving by pawls on studs in chain relieves wheel bearings from the driving strain to which they are subjected with other types of drivers.

An added feature in the above illustration is that all gears are totally enclosed and run in oil, thus prolonging their life and keeping them free from dust and grit.

WE DESIGN AND BUILD:

Industrial Railways, Automatic Railways, Cable Railways, Cars, Tracks, Switches, Motor Cars, Scales, Conveyors, Skip Hoists, Electric Vibrating Screens, Cut-Off Valves, or Gates, Weighing and Measuring Devices, Coal Crackers, "Stevedore" Transmission Rope and Hoisting Rope.

"* * * the greatest handicap to efficient business operation is that of incomplete, inadequate and inaccurate information relative to costs and profits," says G. Charter Harrison, in his splendid book, "Cost Accounting to Aid Production."

Computing production costs by intuition, guesswork, incomplete and inaccurate information is too frequently indulged in to provide a working basis upon which to formulate selling costs.

There's the cost of handling coal from car or barge; the cost of rehandling this coal in the plant; and the removal of the resultant ashes. These functions, vitally necessary in the production of power, light and heat, are not always credited in their true proportions.

For example: Inadequate or obsolete apparatus may be causing too frequent shutdowns, resulting in retarded output and expensive repairs;—unsuitable layout may prove too costly;—employment of manual labor where machinery would do the work better, faster and with greater economy;—these are some of the reasons why the initial cost of manufacture is too high.

If the details of the various items entering into the handling costs were shown in their true relation to the production cost, a firmer basis for a reliable and profitable selling cost could be established. Closer study of handling problems would soon disclose the intimate relationship between them and the ultimate profit on sales.

For over half a century Hunt Cost-Cutting Equipment has effected notable economies in handling coal, ashes and similar bulk material in every class of industry through its ability to meet all requirements of a perfect system for saving money, time and labor.

Hunt Engineers will gladly lend a helping hand to smooth the way to better profit by planning a suitable coal and ashes handling and rehandling system.

C. W. HUNT COMPANY, Inc.

West New Brighton, New York City

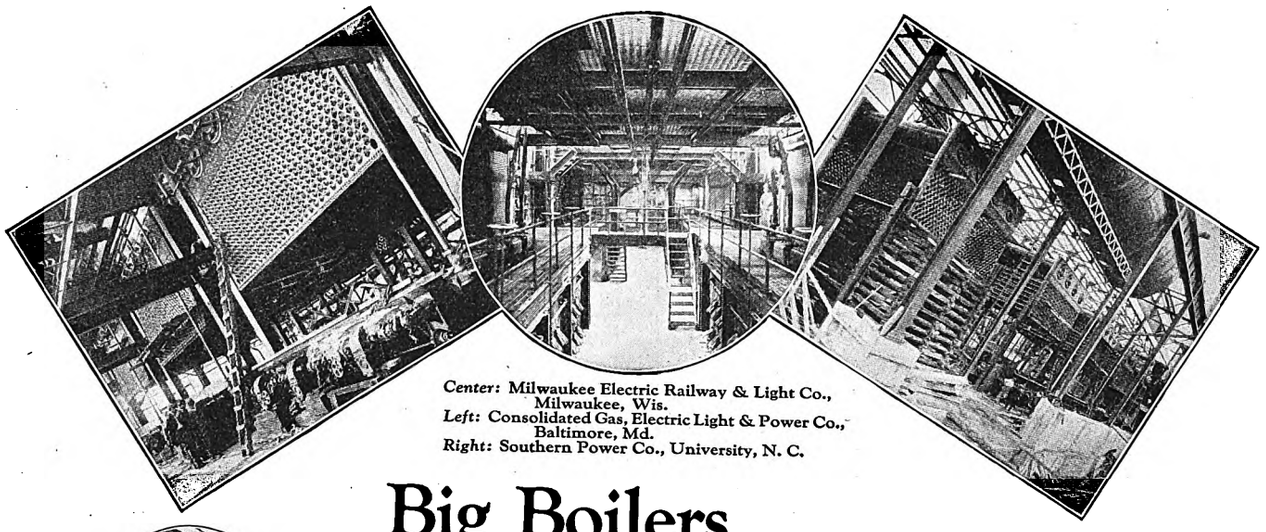
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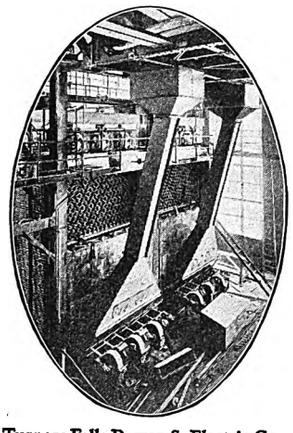
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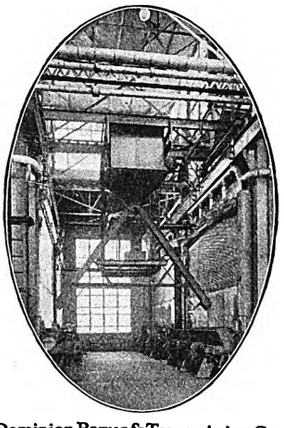


Center: Milwaukee Electric Railway & Light Co., Milwaukee, Wis.
Left: Consolidated Gas, Electric Light & Power Co., Baltimore, Md.
Right: Southern Power Co., University, N. C.

Big Boilers in Big Plants



Turners Falls Power & Electric Co., Turners Falls, Mass.



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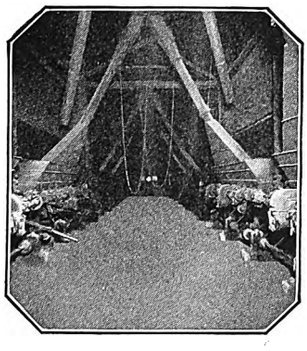
THE seven plants illustrated on this page represent the latest and most modern central station construction. The equipment throughout each of them has been selected because of its superior advantages of economy, efficiency and durability.

There are in service in these seven plants 185 Edge Moor Boilers totalling approximately 160,000 boiler horsepower — an average of about 866 H. P. per boiler.

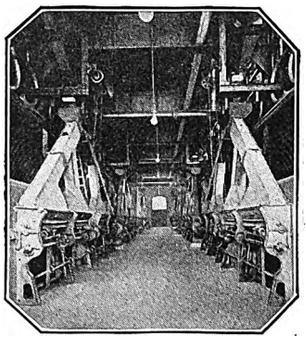
Twenty concerns have a total of more than 400,000 H. P. of Edge Moor Boilers—averaging over 20,000 H. P. for each user.

The fact that every one of these twenty purchasers has sent in several repeat orders is proof of the quality of service rendered by the Edge Moor Boiler in large plants and large units.

Have you written for your copy of the Edge Moor catalogue?



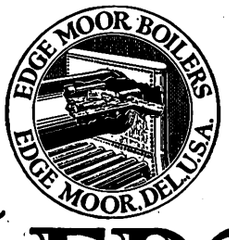
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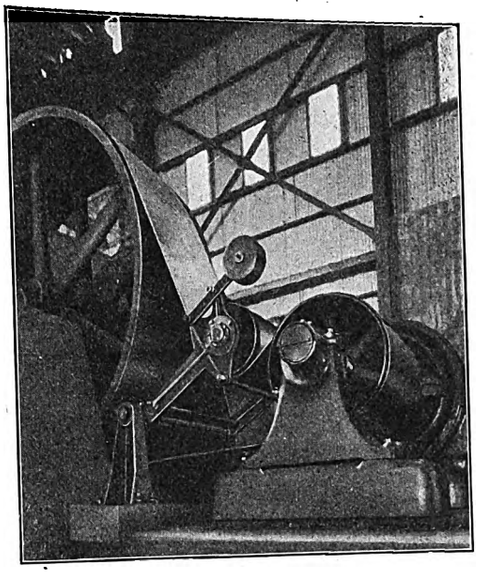


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The superintendent says:

"The Lenix has always given good service. We have never found it necessary to do any repairs on same with exception of changing an occasional bearing."

This statement from one who has used a Lenix Belt Drive for more than *nine years* is proof of the soundness of the design and construction of the Lenix.

The Lenix is not an idler. It is a "belt wrapper" scientifically applied to belt drives for the purpose of eliminating slippage and increasing the general efficiency of the drive.

Booklet

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contains interesting data on belt drives. Send for a copy.

*Registered.

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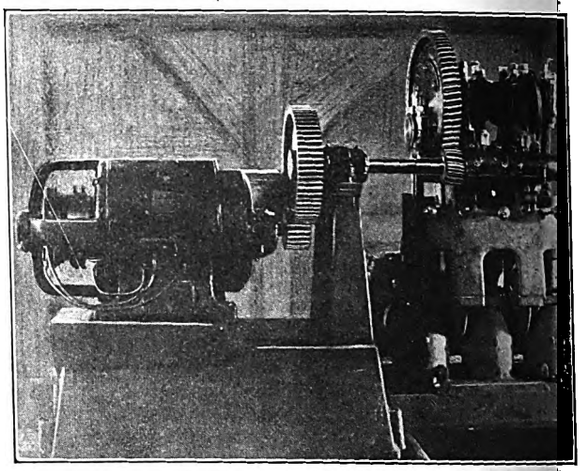
50 Church Street, New York, N. Y.

(*Continued from page* 56)

is similar in principle to that of spur gearing; therefore corresponding grades of gear lubricants can be used.

Worm gears are used where motion is to be transmitted in a right angular direction, or in effect, where two non-intersecting shafts are involved located at right angles, one being above the other. On one of these shafts is fitted a common spur gear, the other carries a collar or drum on which is cut a continuous helical gear tooth all around its surface. Under ordinary operation, the latter, known as the worm gear, serves as the driver, the spur gear being the driven element. Worm gear mechanisms are usually installed where a comparatively large speed reduction is desired with the fewest number of gears.

Worm gears are compact, and, under ordinary conditions, run smoothly where they are properly lubricated. They, however, will frequently present a rather difficult lubricating problem, especially where equipped with roller or ball thrust bearings for the purpose of taking up the end thrust of the worm. In many installations the same lubricant must serve both the gears and thrust



Spur and herringbone gears employed in the drive of a vertical pump.

bearings, unless the latter can be lubricated independently. As a result, rather opposite requirements will be imposed upon the lubricant—the gear teeth requiring a relatively heavy product to counteract the squeezing out pressure exerted by the teeth; while the thrust bearing works best where a considerably lighter product is used.

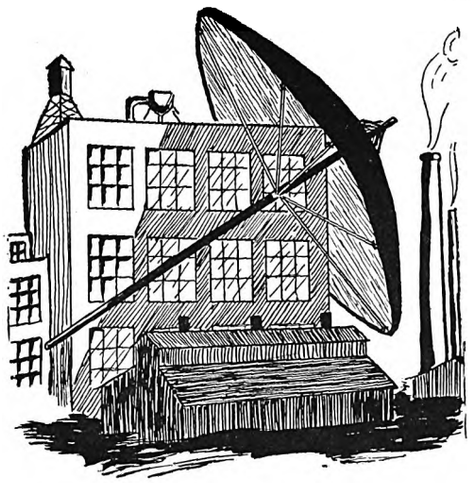
The average worm gear installation is bath lubricated, either the worm or spur gear dipping into the lubricant to the extent of perhaps the depth of the teeth. Upon rotation, lubricant is thus carried to the teeth of the upper element in a sufficient amount to afford a suitable protective film, but yet not in excess to cause "drag." A relatively fluid straight mineral gear lubricant of low pour test will, generally, function best in a worm gear installation and meet all variations in operating conditions most satisfactorily.

We have briefly reviewed the more usual types of gears that will be met with in the average plant today in order to gain an insight into their lubricating requirements. Now let us look into the selection of the various proper lubricants to meet these requirements. In general, the ideal gear lubricant must possess certain very definite properties such as—

(*Contiued on page* 62)

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Like a Sunshade over your Plant

As manufacturers know, production increases tremendously on days when there is a haze in the atmosphere, lessening the intense glare of the sun.

BLU-EE, on the window glass, makes this condition constant, prevents eye-strain, allowing no glare, shadows, nor sweltering heat to penetrate into the factory. It acts as a huge sunshade over your plant.

No matter how dazzlingly the sun shines outside, BLU-EE filters out the blinding heat rays and allows only the light rays to enter.

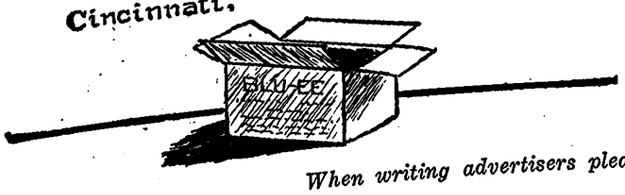


It is more effective than awnings or shades and costs only a fraction as much. Will not rub off, but can be easily removed with warm water.

OUR OFFER

We will send you a box containing two packages of BLU-EE,—enough to cover 2,000 square feet. Use one of the packages as a trial. If you are not satisfied with the result, return the other at our expense and forget the matter. If it is satisfactory, mail us your check for $5.00 (Discounts for quantity orders). Fair enough, isn't it?

PARK CHEMICAL COMPANY
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(*Continued from page* 60)

1. Sufficient stickiness to insure that it will remain on the teeth and resist the action of centrifugal force.
2. A fairly heavy body in order to resist the effects of heat, and form a suitable film regardless of tooth pressures or temperatures.
3. No tendency to harden or become brittle and chip off in event of exposure to abnormally low temperatures.
4. Sufficient "oiliness" or lubricating ability to reduce the friction which occurs between the teeth, to a minimum.
5. Sufficiently low cost to enable it to be purchased and applied at a reasonable expenditure in comparison with the value of the service rendered.

All who have to do with industrial plant operation are coming more and more to realize the importance of these requirements in their gear lubricants. By many of them the preservation of their gears is, in fact, regarded as a primary factor in the attainment of maximum production, for they realize the magnitude to which the expense due to replacements, lost time and idle machinery can approach. In fact, using an unsuitable gear lubricant is very nearly as bad as using no lubricant at all, for rusting, premature wear, stripped teeth, excessive noise and detrimental vibration in the entire machine may result, to the undoing of maximum efficiency in the matter of production.

Gear installations involve pressures which are usually high, and especially severe on the bearing surfaces inasmuch as they are borne by a relatively small area of contact. Also, this is a constantly shifting pressure, whereby the metal is subjected to varying directions of load application. Were rolling contact alone involved, the intensity of such a load momentarily on any part of a gear tooth could be disregarded. But sliding motion is practically always present as well, and this explains the abnormal wear that occurs where gears are not properly lubricated, or where the tooth surfaces are subjected to a continual grinding action.

To meet the requirements stated above, numerous gear lubricants have been prepared. In general, they will vary all the way from fluid mineral oils such as steam cylinder stocks, to intricate grease compounds full of all sorts of "fillers" which the makers fondly believe will serve the purpose intended. "Fillers" such as talc, rosin, soapstone, etc., however, serve but one purpose in a lubricant—to give it viscosity and weight. None of them have any appreciable lubricating value. Therefore they should not be used as they are deceiving, and may lead an uninformed user to believe that his lubricant is suitable, when, in reality, it is affording comparatively poor protection against wear. Any such product containing foreign matter will necessarily have low adhesive characteristics. As a result, when used under high speed conditions or wherever the gears may come in contact with water, acids, alkalis, or chemical fumes, the teeth may very soon lose their protective film of lubricant due either to the action of centrifugal force, or washing.

Again where greases are involved, we must remember that from a lubricating point of view, they will only be as good as the mineral oil which has been used in their make-up. The soap constituent serves merely as a sponge

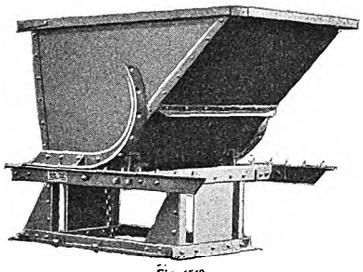
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Fig. 6749

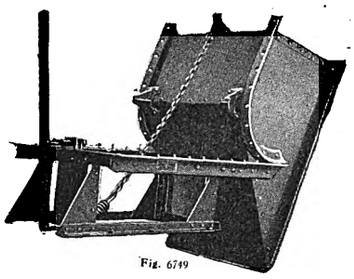
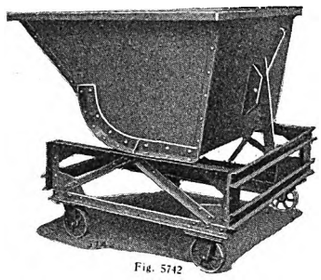
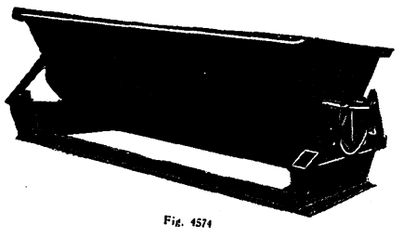
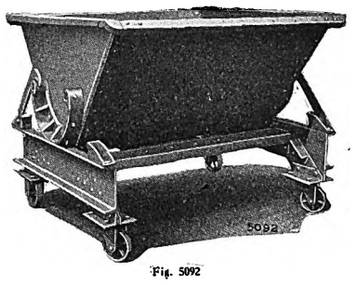

Fig. 6749

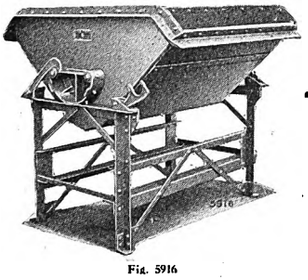

Fig. 5904

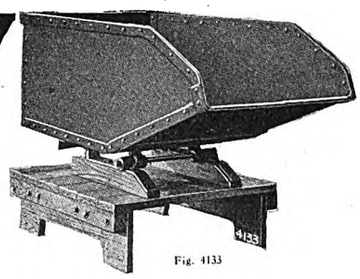

Fig. 5742

for Every Industrial Purpose


Fig. 4574


Fig. 5092


Fig. 5916


Fig. 4133

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through Jeffrey Material Handling Methods

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The company makes the best use of the labor it employs; makes the dollars invested in labor yield a high dividend; forestalls labor shortage in its plant and paves the way toward greater production.

The workman is relieved of laborious, menial tasks, and—with increased plant production—is given opportunity for more remunerative, more congenial employment, where he can be of greater value to himself and his employer.

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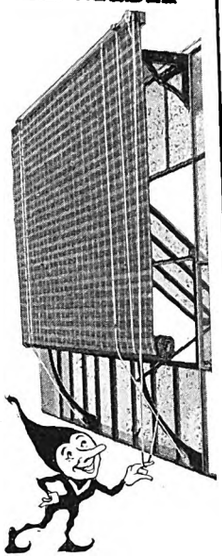
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OFFSET WOOD FABRIC
SHADES FOR STEEL SASH

Light without heat and glare, and fresh air without draughts will increase the efficiency of your employees and add materially to your profits this year.

Secure these benefits for yourself and everyone in your employ now—equip with Ratox Shades. Suspended from enameled steel brackets which are secured directly to the steel sash, they are guided around the center swing ventilator and brought back flush to the wall, at the base, out of the way of machinery or workers—*independent action of center swing ventilator and shade.*

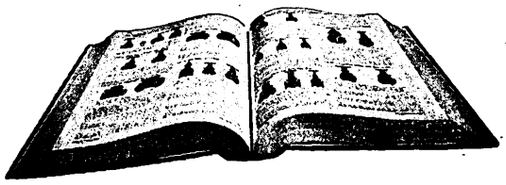
With average care they will serve 20 years or longer. Built of stained bass-wood strips woven parallel with hard twist seine twine.

Send specifications for price quotation and descriptive literature. Write now, before hot weather sets in. Please address correspondence to estimating department.



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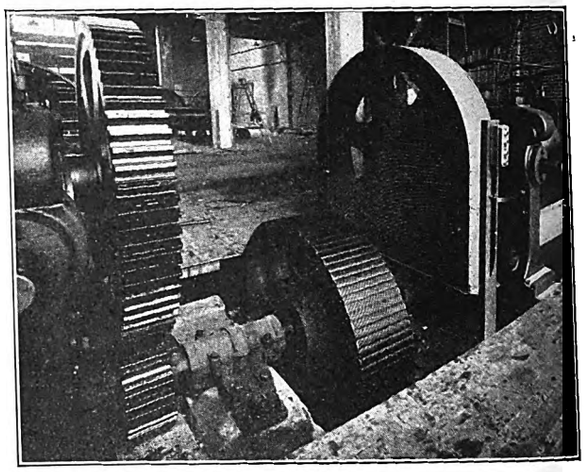
See Sweet's Engineering Catalogue

(*Continued from page* 62)

to carry the oil and retain it in a more or less solid mass according to the percentages of soap and oil which have been used.

Inasmuch as this soap constituent serves no purpose as a lubricant, it is regarded by many authorities as better practice to endeavor to obtain the desired viscosity directly from the mineral oil itself, rather than by using an artificial thickener. This is readily accomplished by simply carrying the process of distillation down until the residuum remaining has been reduced to the necessary thickness or viscosity. Thereby is it possible to obtain a maximum of the desirable properties such as adhesion and lubricating value. On the other hand, if further body is desired, the addition of soaps, animal oil compounds or asphaltum will serve the purpose, and the finished product will be sure to satisfy the essential requirements.

One of the chief faults with any type of light oil grease is that it will often apparently function quite satisfactorily, yet the film created upon the gear teeth will be entirely inadequate to resist the squeezing out action



Chain drive and spur gearing in use on the same unit.

involved. The reason is that the tips of the teeth often exert a so-called "smearing" action on the sides of the adjacent teeth when rolling out of mesh, picking up a certain amount of lubricant which has been forced down between them. As a result the teeth may appear to be carrying sufficient lubricant, yet this only will be present after the pressure between teeth has been relieved. Immediately subsequent teeth engage, due to this lubricant being unable to withstand the pressures, metal-to-metal contact may take place with resultant wear and abrasion.

There are two adverse operating conditions that a gear lubricant may normally be expected to encounter, i.e.,

1. Considerable amount of dust in the air as a result of materials used in the plant, and
2. Excessively heavy pressures such as are customary on certain types of machinery as steel mill rollers or rubber plant mixers or printing machinery.

Where dust must be counteracted, care should be taken to see that the gear lubricant is light enough to absorb considerable of this before it rolls up into balls and throws off. Yet it should still be heavy enough to withstand the bearing pressures on the teeth over the length of time intervening between applications. It must

(*Continued on page* 68)

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Forget what Grandfather's engineers THOUGHT *about Hot Water Heating— Find out what modern engineers* KNOW

"A UNIFORM temperature in the plant regardless of weather conditions."

W. S. McKinstry,
of Winton (Ohio) Engine Works.

"HEATING the additional floor-space (48,600 sq. ft.) is paid for by the saving effected by the use of Hot Water Heat in the main building."

W. T. Cowell,
of Lodge & Shipley.

FACT statements these, based on actual experiences. They are typical of the reports from many of this country's biggest manufacturers, all going to prove conclusively that modern Hot Water Heating Systems actually save 20% to 50% of industrial heating costs.

The modern way to install heating systems in industrial plants is on a performance basis. Modern factory owners want results! Results such as even temperatures in their plants in all weathers, at minimum cost. Results such as are registered in the accompanying chart, which shows one day's heating performance when the outside thermometer took a characteristic drop of 30 degrees.

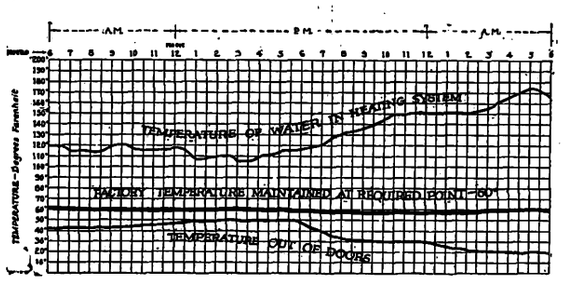


Chart made by recording thermometers in Parish & Bingham Corp. plant at Cleveland, where temperature required is 60 degrees. An even temperature maintained all day despite outside temperature of wide fluctuations. Note that the heating medium (Hot Water) was never above 175°. When required it was as low as 105°. With Steam 212° is necessary whenever you want any heat.

Performance such as is illustrated in the chart is possible only with hot water systems.

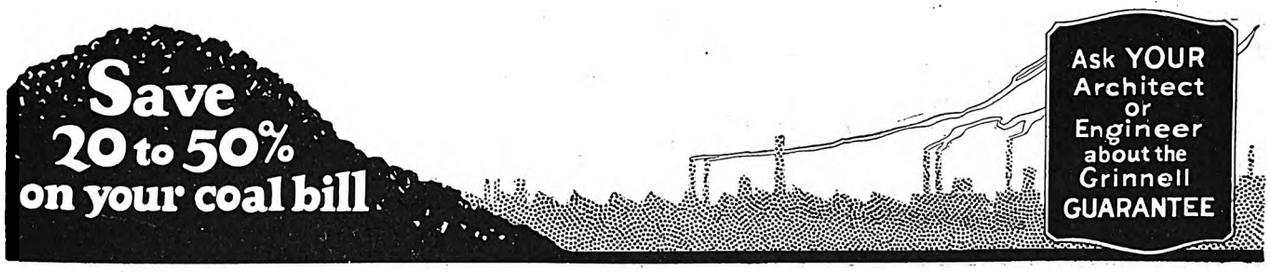
Yet many manufacturers go right ahead, blindly wasting thousands of dollars installing heating systems which may or may not prove satisfactory, without even making an attempt to get the facts as a basis for comparison.

You recognize the need of better performance in heating your factory; and you are entitled to expect it—no matter how large your plant or how unusual its operating conditions.

There are six important reasons why manufacturers have never learned all the facts about Hot Water Heating economies.

You want to know these reasons. You ought to know them.

They are too technical to explain here. Ask us to write you about these reasons. They will surprise you. They will show you why the Grinnell plan of installing heating systems on a Guaranteed Performance basis is the only logical way to attack this problem. Your Architect or Engineer will tell you how this guarantee dovetails in with his specifications. Address any inquiry you wish to make of us to Grinnell Company, Inc., 307 W. Exchange St., Providence, R. I.



GRINNELL COMPANY

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WHEN the last lick is struck on a Plibrico Furnace Lining, the final blow has been dealt furnace troubles for years to come. This unmatched endurance is simply the certain result of building furnace walls that are not weakened by joints —walls that are ALL refractory.

Plibrico is the highest quality refractory — in plastic form, so that it is easily conformed to any furnace shape by unskilled labor. When baked by slow heat it is vitrified into a rock-like lining that will resist temperatures to 3100 degrees F.

Have you read the big book, "Refractories and Furnace Design"? Ask for a copy.

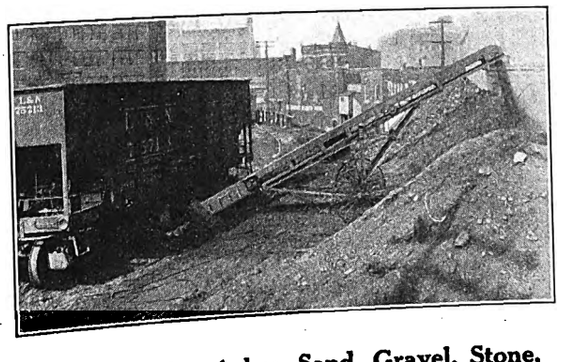
Plibrico is delivered only in red steel containers of distinctive appearance as shown below. Warehouse stocks in over 80 cities—see 'phone books.

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LABOR AT 10c AN HOUR



Coal, Coke, Ashes, Sand, Gravel, Stone, Refuse, and other bulk materials handled mechanically at the rate of a ton per minute.

National Conveying equipments are equivalent to at least 5 men shoveling. Operating cost 10c. per hour or less.

Cars and trucks loaded and unloaded. Storage capacity increased.

Manufactured in various types and lengths to meet every requirement.

A line from you will bring full information.

NATIONAL CONVEYING EQUIPMENT CORP.
1140 North Kilbourne Ave. Chicago, Ill.

(*Continued from page 66*)

be remembered that a lighter grade of lubricant will often last longer and yield better results under dusty conditions; the heavier grade of compound that would usually be used under clean operation can not be expected to maintain an efficient lubricating film in such cases. Rubber mixers are a typical example of the above. Here, as in some other instances, it may even be advisable to use a lubricant so much lighter that it will be practically fluid at operating temperatures.

To further appreciate the extent to which conditions of the above nature may affect the performance of a gear lubricant, it is interesting to note the several successive reactions to which the latter will be subjected. Essentially there are three distinct phases involved, i.e.:

1. When the point of the gear tooth comes in contact with the root of the companion pinion tooth.
2. Where both teeth are in contact adjacent to their pitch lines, and
3. Where the reverse of the first takes place as the teeth pass out of mesh.

If any sliding motion takes place at all, it is most likely to occur when the teeth first come in contact and as they become disengaged, the points of the respective elements exerting a more or less scraping action on the sides of the adjacent teeth. Therefore both wiping action and squeezing will be most apt to occur at these times. As the teeth become more and more engaged, however, sliding contact is replaced by rolling contact; in other words, we approach the ideal operating condition for gearing. Wiping or scraping off of the lubricant is therefore practically eliminated, but the squeezing out action still is possible, especially as maximum bearing pressures are encountered during the time the teeth are so engaged. In other words, wear will occur more rapidly at the points and roots of the teeth due to the sliding friction involved.

THE methods employed in the application of gear lubricants will depend largely upon the service involved. For example, the gears in an automobile transmission are usually bath lubricated; the smaller trains of gears in the front end of automobile engines, which often serve as sprockets for silent chain drives, are generally lubricated by the engine oil; the gears which drive the rolls on certain rubber machines may be either bath or hand lubricated; the gearing on excavating machinery is practically always hand oiled, while turbine reduction gears are often served by force feed. So we have a wide variety of conditions, each of which may require special consideration according to the design of the machine, the size and number of the gears and the products being handled. Certain of these latter will be of a perishable nature such as food stuffs, paper and textiles. As a result, any gearing involved must be so lubricated that there will be practically no chance of the gear compound splashing, dripping or being thrown onto these products. Others require little or no consideration of this nature and oftentimes, in such cases, even waste oils are slopped all over the machinery due to careless lubrication of the gears. Gear lubrication can be regarded as applicable to five distinct methods of operation, i.e.:

1. Where the gears run in an enclosed casing,

(*Continued on page 70*)

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What Self-Analysis Can Do

To or For { **A Foreman** / **A Superintendent** / **A General Manager** } { **A Treasurer** / **A President** } ***and for his Company***

Try it. Many progressive men who are working with the interest of their Company at heart, continue year by year along a definite path with their attention focused on specific phases, and allow opportunity after opportunity to make savings (stop losses) to go by, simply because they have not asked themselves the following question—"CAN'T I IN SOME WAY CUT DOWN THE EXPENSE OF HANDLING, REHANDLING AND RE-HANDLING MY MATERIALS?" The answer is so evident that the tendency is to simply do any one of a number of things; such as buy this, or buy that; or try out this, or that. Carry this SELF ANALYSIS further and ask yourself—"DO I WANT THE GREATEST POSSIBLE SAVING?" The answer is "Yes." Right here we believe you will agree with us in diagnosing a physical ailment, you consult a diagnostician and get the best specialist you can find to prescribe the remedy.

Your MAN-REHANDLINGS can be reduced. COWAN TRUCK COMPANY can diagnose your material handling problem and supply the specialist who can cooperate with your own men in recommending a cure and supplying the proper equipment. COWAN prices not only cover the best product of its kind built, but include the services of this specialist.

The platform lift truck idea offers to you the greatest possible economies provided COWAN platforms and COWAN lift trucks are properly applied.

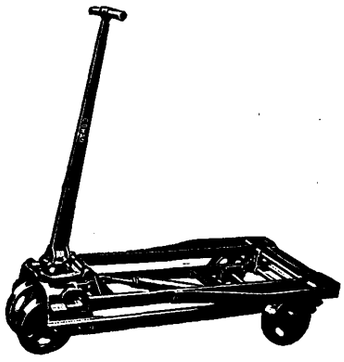
The COWAN TRUCK COMPANY offers you the most economical equipment you can purchase, not always in price, but in the thing you really pay for—results.

COWAN Long Life Skids have built into them long life, low maintenance and the ability to stand up. These features are accomplished through the use of certified malleable iron feet, riveted to the side flanges of Commercial angle iron and bolted through the top flanges of this angle to the best grade of wood decking. Oversized flat headed bolts are used and decking is countersunk so top surface is flush.

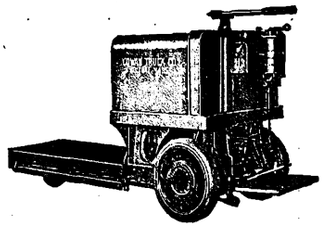


COWAN Type G Hand Lifting Machines (trucks) have personality and are superior due to COWAN'S patented lifting mechanism.

The study of our customers' problems has actuated the careful thought put into the design and workmanship of COWAN trucks and is the reason why COWAN is the largest manufacturer of Hand and Electric Lift Trucks in the world.



COWAN Model LLT Electric Elevating Machines (TRUCKS) have by actual test super qualities such as simplicity, strength, flexibility, ease of control. Many of the difficulties that have been experienced in electric industrial truck design have been eliminated in this new COWAN Model LLT.



25 COWAN Long Life Skid Platforms and one Hand or electric elevating machine gives you the equivalent of 25 ordinary platform trucks. Not only is the initial cost less, but the maintenance is reduced because of the superiority of COWAN and the fact that the number of moving parts has been cut practically to 1-25th.

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(*Continued from page* 68)

out of contact with the bearing lubricant, being bath or force feed lubricated.

2. Where they run in an enclosed bath, the gear lubricant at the same time serving the bearings as is true in many reduction gear installations.

3. Where gears are entirely exposed, the lubricant being applied by hand.

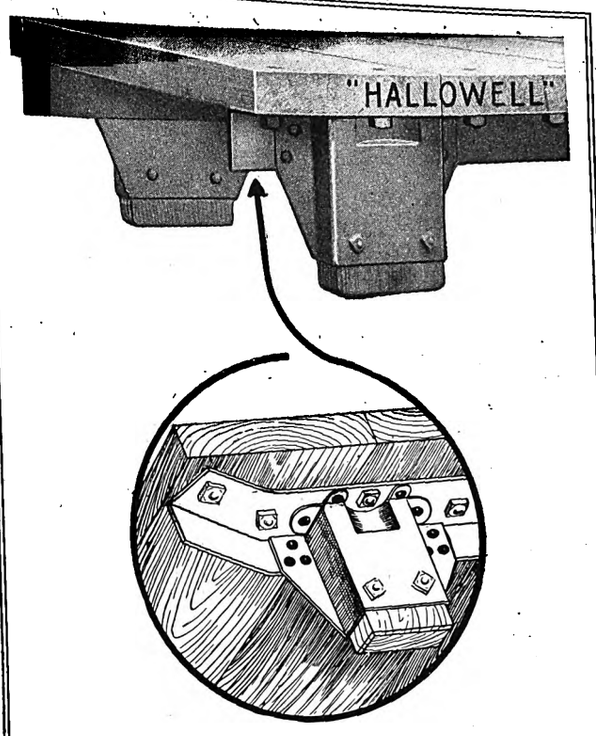
4. Where the gears run exposed, but with their lower portions so encased as to render bath lubrication possible.

5. Where gears are entirely exposed, and subject to such dirty conditions as to render practically any lubrication inefficient, however refined the lubricant may be.

Where and when to use any specific grade of lubricant is, therefore, evidently oftentimes a problem. In general, however, for all methods of lubrication, except the second (as stated above), we will find that the more we adhere to the use of straight mineral, higher viscosity gear lubricants, the better will be the resultant service. Where bearings must be lubricated as well by the same product, naturally a lighter bodied or more fluid lubricant must be used. We must, however, remember that tooth pressures may often be so high as to exert quite a squeezing out action, therefore, a compromise will frequently be necessary in regard to how low the viscosity of the oil should be. Reduction gears in connection with steam turbine installations are a typical example of where a high grade straight mineral oil must be used for bearing service, but having such a viscosity at the operating temperature in the gear case as to serve at the same time as an effective gear lubricant.

The type of lubricant is therefore very essential in the obtaining of proper gear lubrication. On the other hand the actual application is of almost equal importance. For example, where pans are furnished for bath lubrication, they should be cleaned out at regular intervals, since any dust that may have gained entry will destroy the adhesiveness of the gear lubricant, tending to form a solid pasty mass which will not stick to the gears. Also where the gears dip in a bath of lubricant, this bath should be just deep enough to cover the lowest teeth.

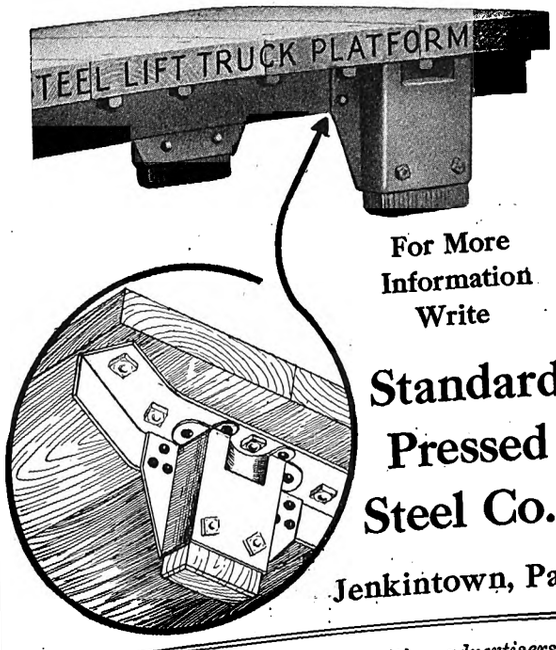
When the lubricant is applied by hand, it should be slightly heated to reduce it to the consistency desired, and painted on the gears with a short brush, or poured on from a dipper as the former are slowly revolved towards each other. Preferably pouring the lubricant on in a fine stream is the easiest, most economical and most effective method and is advised wherever possible. Gear lubricants should be applied to open gearing in small quantities and relatively frequently, rather than in considerable volumes and at longer intervals. Thus there will be less danger of gobs of lubricant being thrown off by centrifugal force, to possibly contaminate the products passing through the machine.



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Hydraulically driven rivets—not bolts—are used to fasten these two parts together. That's one reason why "Hallowell" platforms stand up under the most unusual tests; that's one reason why "Hallowell" platforms are in every day use long after the average platform is in the scrap heap.

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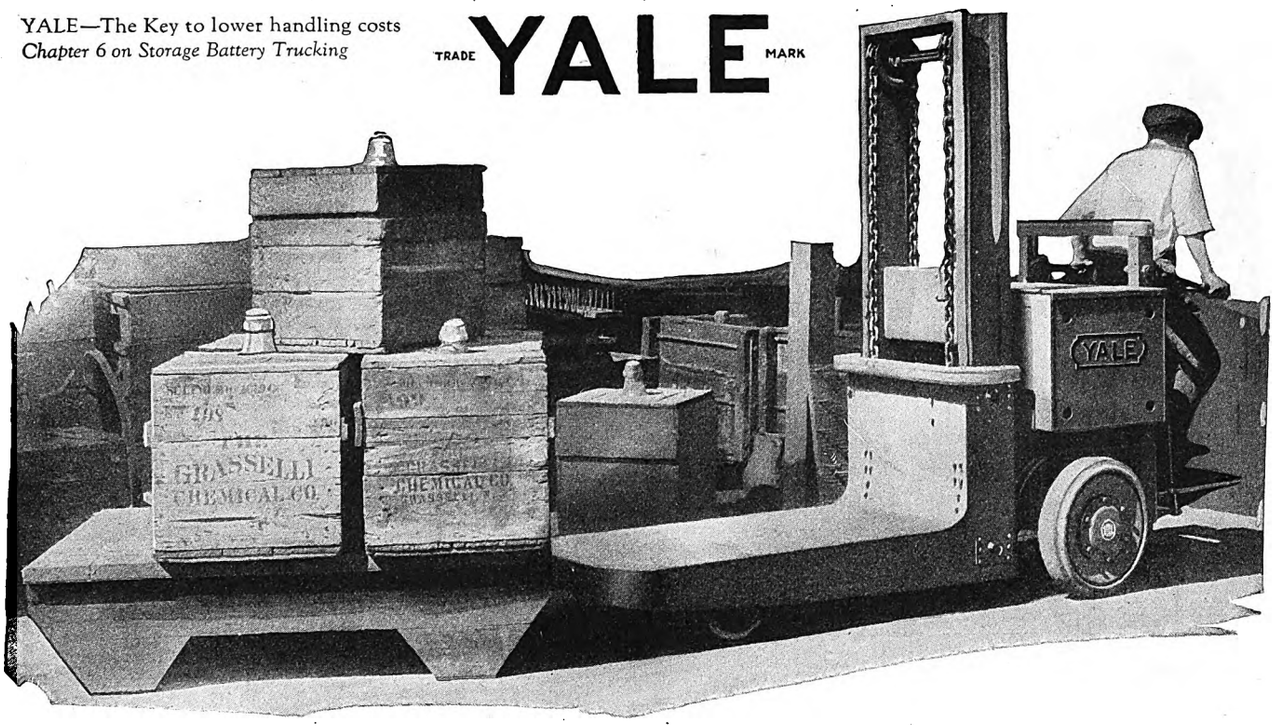
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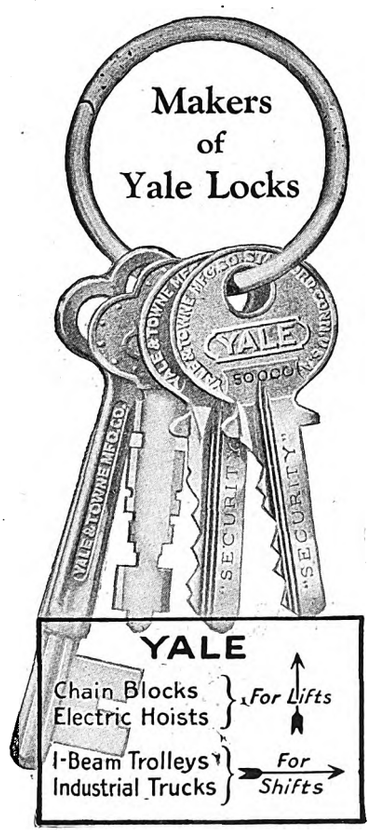
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Ask our engineers to make a transportation survey of your plant. There's no obligation, and you can be sure they will recommend Yale Trucks only when there's a clear profit to you.

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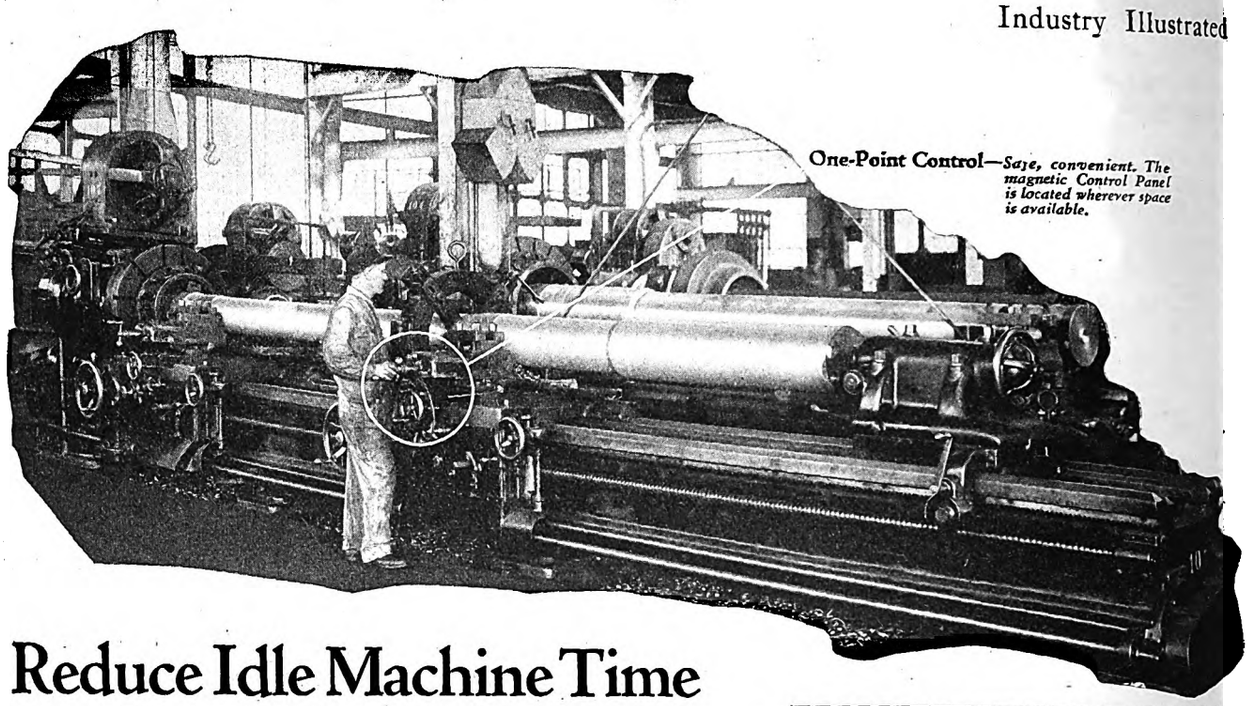
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One-Point Control—*Safe, convenient. The magnetic Control Panel is located wherever space is available.*

Reduce Idle Machine Time

The easy, convenient control of the starting, stopping, reversing, and speed adjustments provided by C-H Automatic Lathe Control all help to reduce production delays. The biggest machines are made to do the will of the operator.

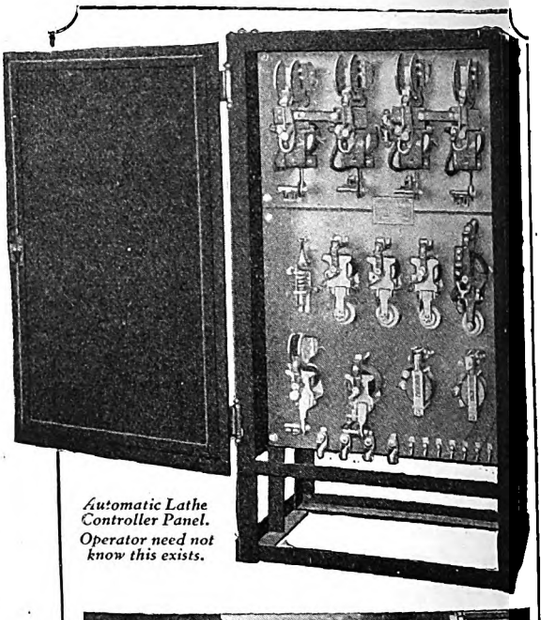
In addition the Cutler-Hammer engineers have developed an ingenious protective relay—the C-H Vibrating Relay which acts as a master brain in controlling the cutting speeds, and safeguarding the tool and motor.

If a hard spot is encountered this Relay automatically slows down the motor and when this spot is passed, it is brought back to the higher speed. This eliminates production delays and chance of damage to motor.

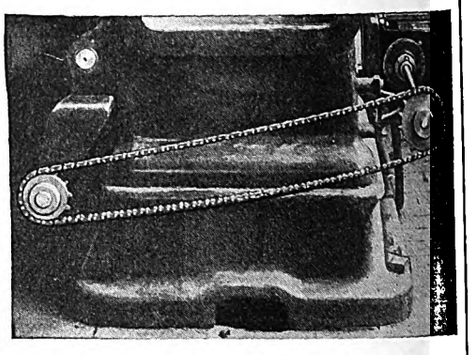
The automatic Overload Relay makes unnecessary the use of friction clutches or other devices to protect the machinery. The Relay gives the protection required, saves the machinery, saves time—eliminates fuse troubles and expense.

Cutler-Hammer Engineers for over a quarter of a century have specialized in the design and application of motor controllers and are at all times ready to consult with you in your motor drive or control problems. Booklet on machine tool control will be mailed on request.

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Works: MILWAUKEE *and* NEW YORK
Offices and Agents in Principal Cities
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Automatic Lathe Controller Panel. Operator need not know this exists.



Illustrating mounting of Lathe Type Master Controller on back of lathe. Connection and operation are through chain drive from spline shaft which runs to apron. The operator's control handle governs the motion of the spline shaft.

C-H CUTLER-HAMMER **LATHE CONTROLLERS**

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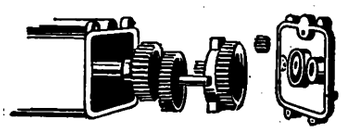
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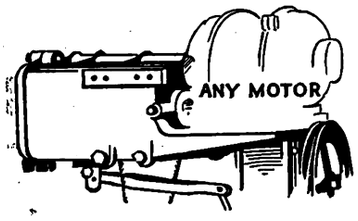
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3 Big Spur Gears.
No delicate parts.
Skilled mechanic not required.
Disassembled without removing hoist.

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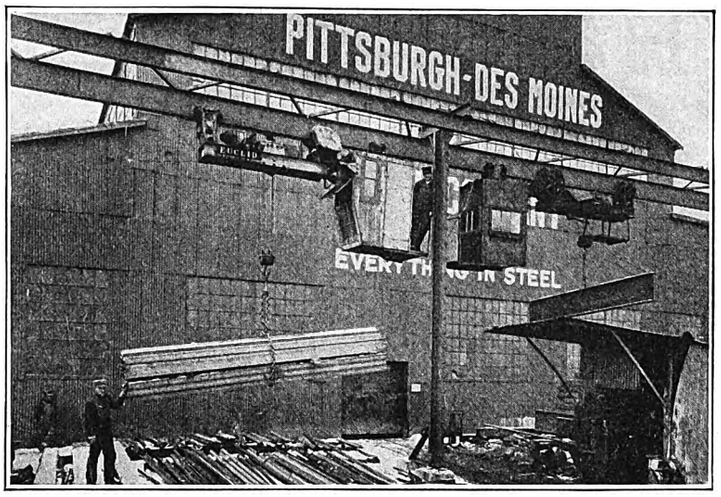
All gears wide face—coarse pitch.
Frame one piece—accurate alignment.
Dependable factor of safety.
Unfailing brakes and limit switches.



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Parts enclosed in oil bath.
All parts to jig—interchangeable.

LOW HEAD ROOM
ACCURATE CONTROL



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is an enthusiastic Euclid Booster. Years ago they bought their first Euclid. Now they own several—of which the illustration shows two 5-ton mono-rail hoists.

Their *conviction* of Euclid superiority in Machinery and Service came from PROOF. The cranes demonstrated their ability under unusually strenuous duty. We *proved* that our interest in our product only *begins* at the time of sale.

Hence "it is worth a $200 to $300 preference to buy machines from you" wrote the General Manager.

And there are hundreds of others who feel the same way.

Let a Euclid Crane or Hoist "raise YOUR profits."

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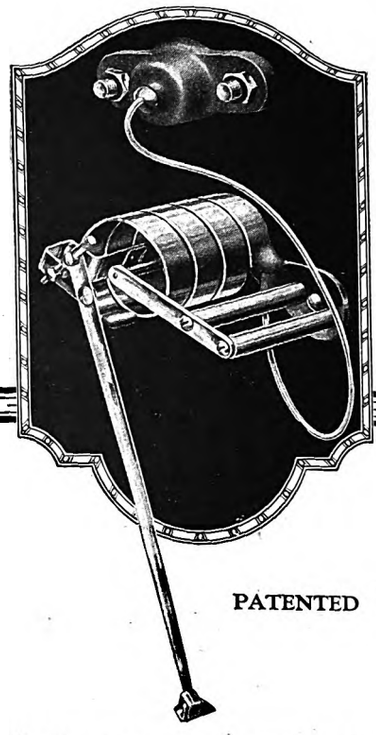
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Note the extreme simplicity of the Foxboro Improved Helical Tube Movement.

It's a wonderful piece of craftsmanship.

There are no cams, levers, multiplying devices and other cumbersome adjustments necessary to keep less sturdy movements in the straight and narrow path.

THE REASON—
The Foxboro Helical Tube Movement is permanent in calibration. That's the important point.

No adjustments are necessary to keep it accurate.

You can use the instrument constantly at maximum chart range without injury.

It will not fatigue, split, leak or crack even when subjected to excess pressures that carry the pen way beyond the outer edge of the chart.

Accuracy within less than 1% of total scale reading is guaranteed.

Simplicity, strength, accuracy, dependability—these are the characteristics of the Foxboro Improved Helical Tube Movement perfected by Foxboro engineers 2½ years ago.

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What Is the Best Type of Roof?

(*Continued from page* 17)

vided with a monitor for light and ventilation.

Often there are monitors of great width, their roof being supported by a truss. This allows convenient space for crane runways, and the height of the monitor provides clearance for the crane above the working floor. Some architects design a roof of peculiar form by continuing one side or pitch beyond the ridge and above it and then joining this false ridge with the other slope by a row of sash standing at an incline of three inches per foot away from the vertical. This one-sided monitor constitutes a sort of sawtooth roof with "A" truss framing, and if the sash are placed on the north side of the building, they act just as the lights in a sawtooth roof and avoid direct sunlight. In any position, however, they act as ventilators.

Instead of putting the monitors at right angles to the trusses supporting the roof, they may be set parallel with them and are formed by the trusses themselves. This arrangement does away with the superfluous space under the trusses and is known as the "high and low bay" roof. Flat topped trusses are set transversely to the length of the building. The roof in the first bay at the end extends from the end wall to the truss and is on a level with the lower chord. Between the first and second trusses, the roof is carried on the top chords of the trusses, and between the second and third trusses it is at the level of the lower chords, thus alternating for the entire length of the building. In the vertical face of each truss glass sash is placed and thus every other pair of trusses is a monitor with glass sides.

A common form of "flush" skylight is set with the glass close to and parallel with the surface of the roof and acts as a window much more effectively than as a ventilator. They can only be considered satisfactory on roofs having considerable slope, as otherwise with their low set frames, flooding during heavy rains or from melting snow is inevitable.

Another type is a standing skylight, and there are several designs for arranging the glass in sash extending above the roof. Usually the top is shaped like a hip roof and the glass is set in light wood or metal frames. They also may have wall sash, like monitors, frequently arranged for affording ventilation. Where there are elevator shafts, light courts and stair-wells, these skylights are very satisfactory.

A design of roof frame used in large armories and formerly standard for railway terminal stations is occasionally employed in industrial buildings. This is the arch, of which there are two varieties. One of these comprises a curved truss of steel or wood and having both the upper and lower chords arched and nearly parallel with each other. The web members are arranged very similarly to a Howe truss. A steel rod, in tension like a bow string, joins the lower ends of the truss, and thus takes care of the thrust. This type may be used for large spans, even more than one hundred feet.

Another design, built up of light, laminated, wooden members, has the upper chord arched and the lower flat, forming a segment of a circle. The latticed web members of the truss may be of one or the other of several systems, in some cases the design being patented. Sometimes, but not usually, this style is used for a one hundred

(*Continued on page* 78)

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an adaptable material for important units

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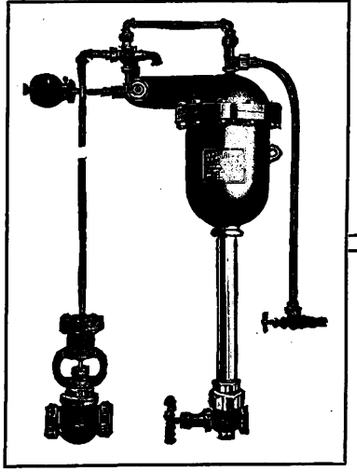
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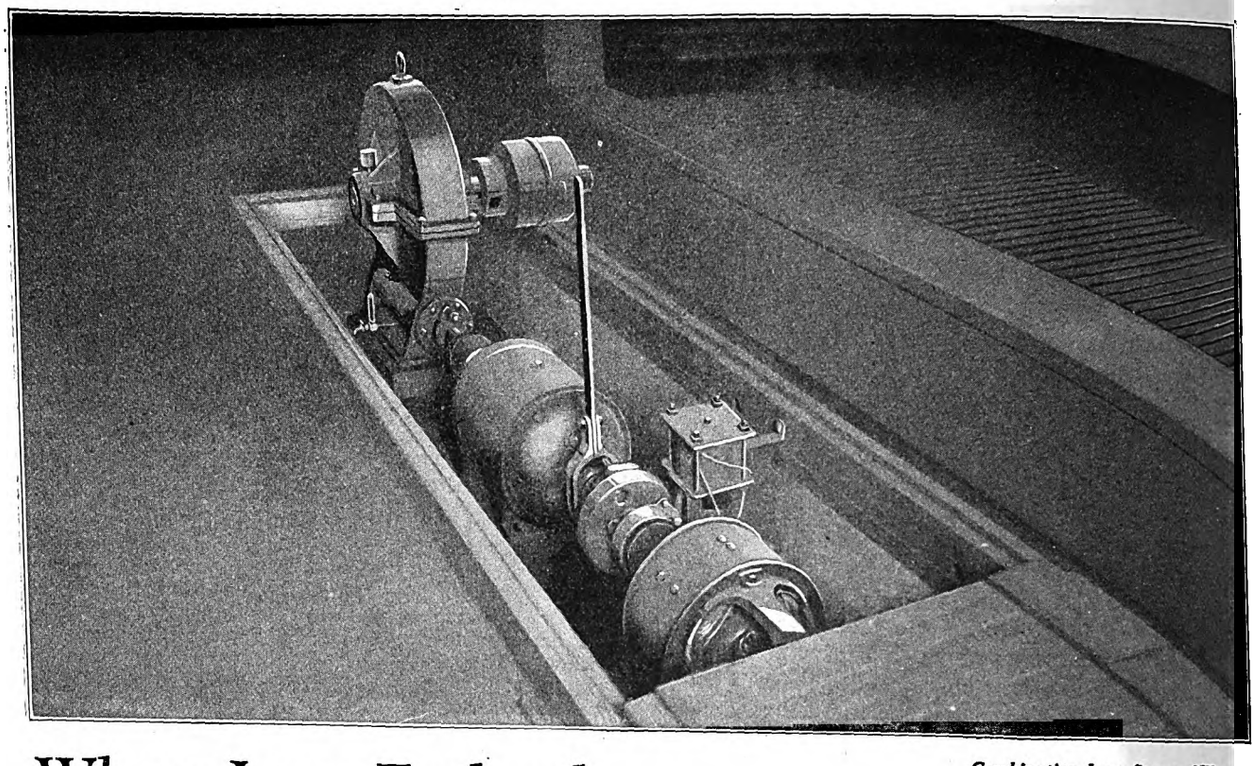
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Vigilant Feed Water Regulator

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Combination Jones Spur and Worm Gear Speed Reducers driving Assembly Conveyor. Motor speed 720 R.P.M. Final speed 0.185 R.P.M.

Where Jones Enclosed Speed Reducers are used

In mills, factories, mines, quarries, warehouses, and many other places, Jones Enclosed Speed Reducers are giving constant satisfaction.

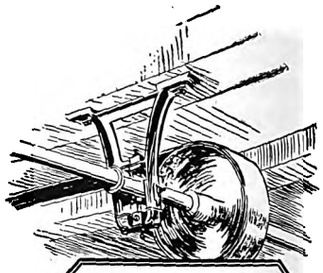
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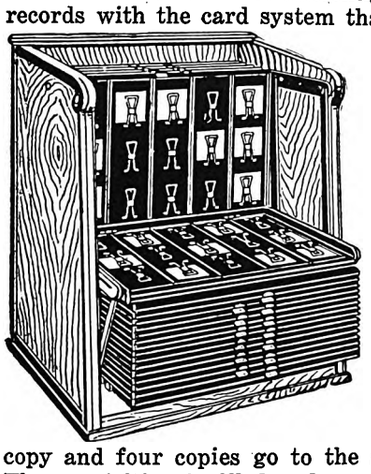


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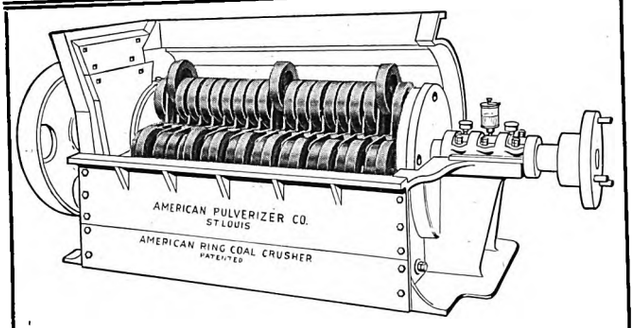
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(*Continued from page* 75)

foot span, but is not in favor with the fire underwriters by reason of the employment of small size lumber in its makeup.

Sawtooth skylights are a series of parallel, triangular skylights having their ridges set in an east and west line and with glass on the north side, so as to receive no direct solar rays. At an angle of 75° slope, the glass is more effectively placed than if vertical. This is done with reference to the latitude of the location and is based upon the sun's deviation from the meridian at the time of the summer solstice, June 20-21. Practically, the sun does not shine directly in, except for a short time in the early morning and late afternoon hours in the beginning of summer. The light coming from the north sky is of very uniform quality.

These sawtooth roofs also have good ventilating qualities if movable sash or ventilators are put in on the ridges. Steel, wood or concrete may be employed in their construction. For support, it is common practice to rely upon a row of columns under each valley, spaced from sixteen to twenty-five feet apart. By using I-beams of proper depth, wider spacing may be secured.

Several plans are effective for obtaining a clear floor space where the sawtooth construction is to be put in. Sometimes a Howe truss is set transversely below the sawteeth, but owing to the space occupied by the depth of the truss, this idea is unnecessarily costly. A Howe truss may be put in back of the glass in a perpendicular position or it may have the same slope as the glass. It is adapted to spans of not more than sixty-five feet.

The "Super-Span" system of trusses, developed and patented by the writer, and seemingly the most economical method of getting large sawtooth spaces free of columns, employs both longitudinal and transverse trusses. A Howe truss, placed behind the glass and correspondingly sloped, gives longitudinal support to the roof for a space of sixty-five feet. At sixty-five foot intervals, these trusses in turn are supported by a transverse truss of the same depth, whose bottom chord is on the level of the valleys and whose top chord extends outside the sawteeth connecting their peaks one to another in groups of two, three or four. The web members of the transverse trusses are the structural members of the sawteeth and they are like a bridge truss except that the angles of the web members are not equal in each pair. This will be apparent by reference to the accompanying illustrations. This transverse truss can be made of one hundred feet span, so that buildings of that width can be provided with roofs without using any columns, no matter of what length (measured parallel with the glass). For buildings wider than one hundred feet, the column spacing is sixty by one hundred feet.

Flat roofs and those with valleys where water may accumulate, such as those on sawtooth buildings, must have a surface composed of materials absolutely impervious to water. For making a watertight covering in such cases, it is usual to apply pitch or asphalt, put on while hot, with layers of paper or felt between each of several coats, and protected with a top surfacing of crushed stone or slag.

The use of pitch or of asphalt depends on the particular case. Pitch will melt at a lower temperature than asphalt and under the rays of a hot sun will soften and run down the slope of a roof unless protected by gravel

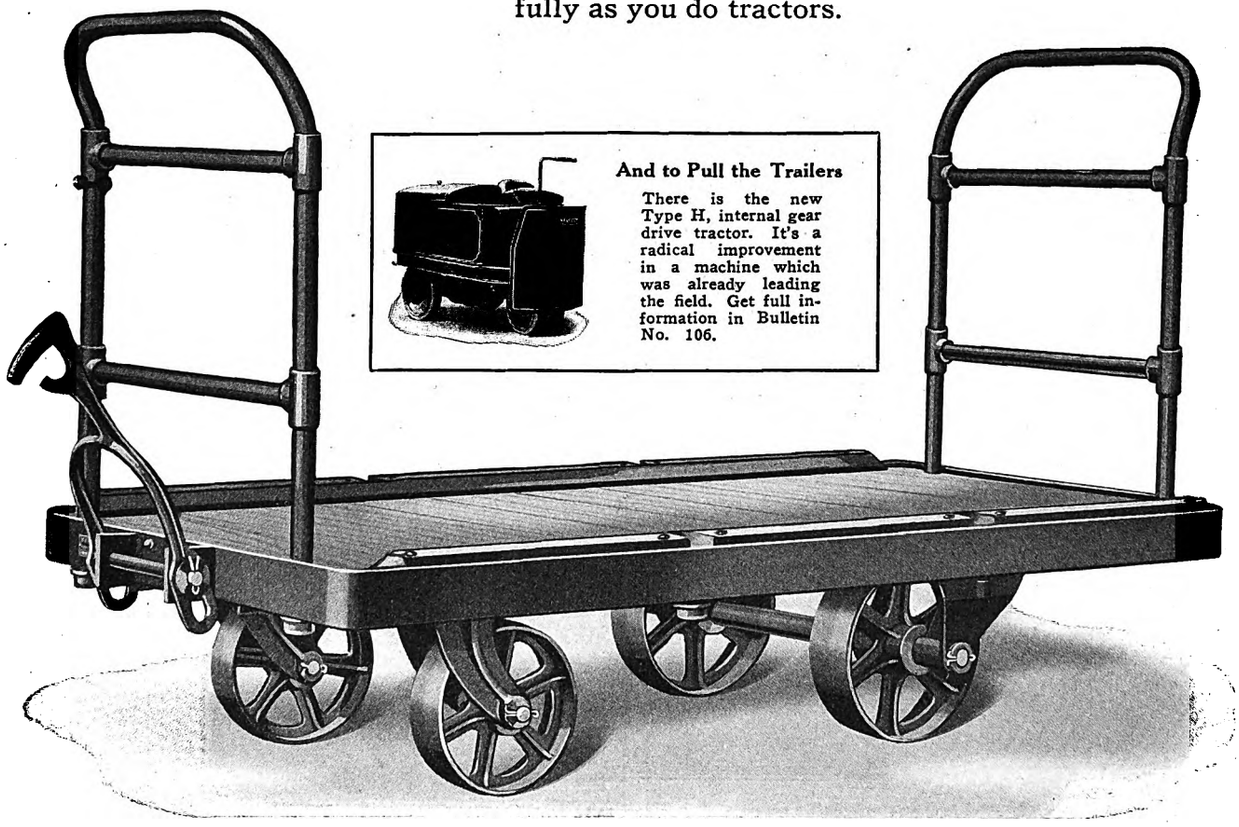
(*Continued on page* 80)

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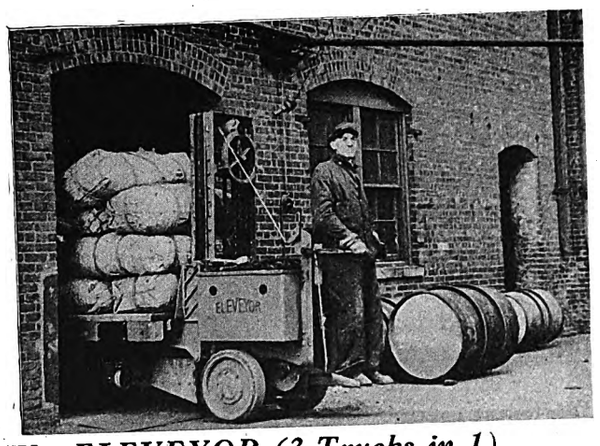
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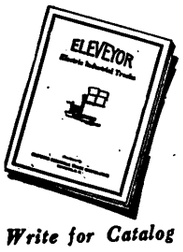
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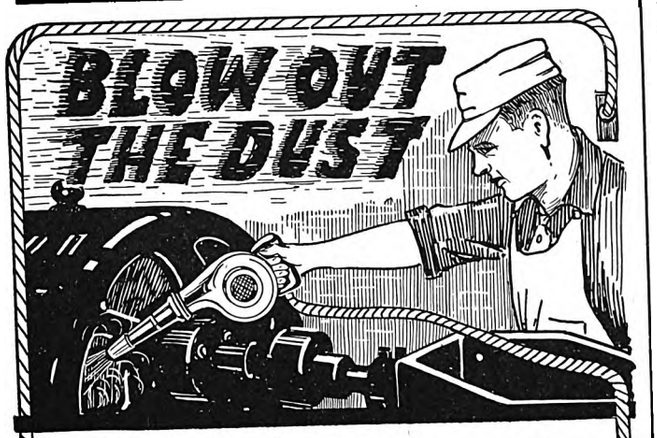
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(*Continued from page 78*)

or slag. This is unnecessary with asphalt, although on sawtooth roofs gravel is often applied, with the incidental advantage that it gives a lighter color and so reflects more light into the adjacent skylights. As between gravel and slag, unless color is the deciding factor, it is simply a question of cost or availability. The webbing used is felt paper impregnated with pitch or asphalt, or asbestos treated with asphalt.

Prepared roofings laid from rolls with a cemented lap are usually made of these same materials. When properly put on they are about the same as a built-up roofing, but tightness is dependent on a single mopped joint in one case, and on perhaps a half-dozen such joints in the other. Roll roofing is adapted to sloping surfaces where the joint is not subjected to water pressure.

There are many materials employed to cover the spaces between the trusses and purlins of the roof structure, and we must now consider these. Wooden planking is in common use. While combustible and liable to decay, it is inexpensive and a poor conductor of heat, and it therefore reduces condensation and aids in conserving heat. Treated with a preservative, its life and fire-resisting properties may be increased at moderate expense, and it will withstand many chemical fumes that soon destroy steel or masonry.

Where the rest of the structure is of concrete, this material may be used for roof construction. Ordinarily, better adapted to flat roofs, it is also widely used for the monitor and sawtooth types. In situations where the air is very moist, concrete requires insulation of some sort to prevent condensation. Several styles of construction have been developed, varying from beam-and-girder and flat slab system to those using tiles made of gypsum, burned clay or metal for the purpose of reducing weight.

Gypsum is obtainable in roof tiles and in large slabs that can be laid directly on angle irons or inverted "T"s, or it may be cast in place with metal reinforcement very much as concrete. In fact, gypsum combines many good properties of both wood and concrete. Non-combustible and permanent and readily handled, it is also a non-conductor of heat and is frequently preferable to wood, except where exposed to acid fumes. Its cost is slightly higher than that of wood.

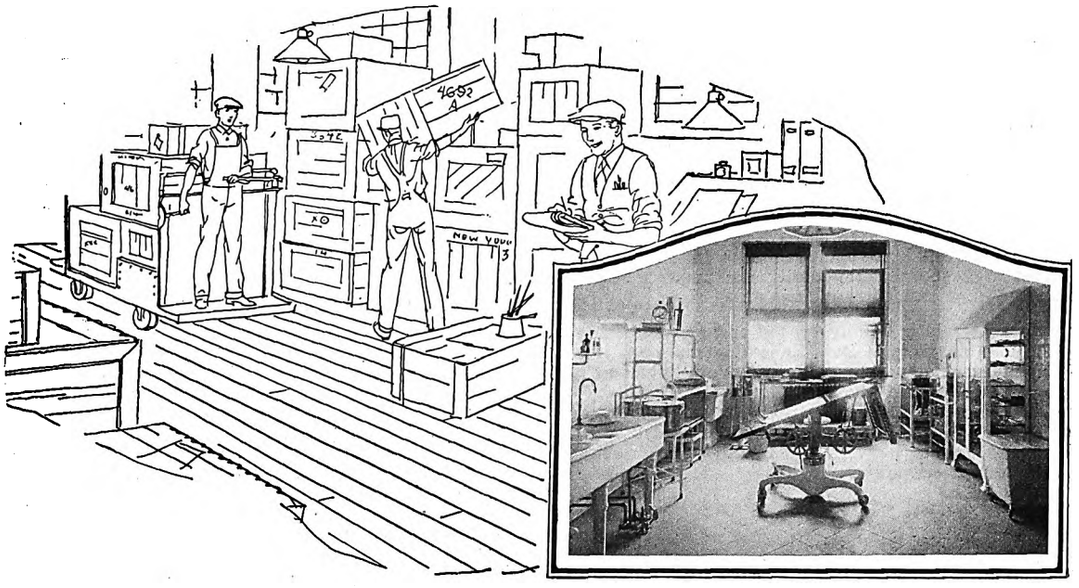
Various metals are available. Corrugated galvanized iron is frequently chosen for temporary, low-cost buildings, but unless a high grade, refined iron is purchased, it does not last long and is very subject to corrosion from chemical fumes. Possessing high heat conductivity, it makes a building hot in summer, cold in winter, and will cause excessive condensation if the air has much humidity. Galvanized iron is obtainable, however, with both surfaces and the edges covered with several layers of asbestos paper cemented to the metal, which largely obviates these objectionable features.

A material rather new in our domestic market is corrugated zinc. Fairly high priced, its permanence and consequent low maintenance cost render it well worthy of consideration. It is more lasting than galvanized iron, rust proof and but slightly liable to corrosion; but like iron, is a very good conductor of heat.

A very permanent material and one that is an excellent resistor of chemical fumes is asbestos. Corrugated sheets and flat asbestos boards are sometimes used. As

(*Continued on page 82*)

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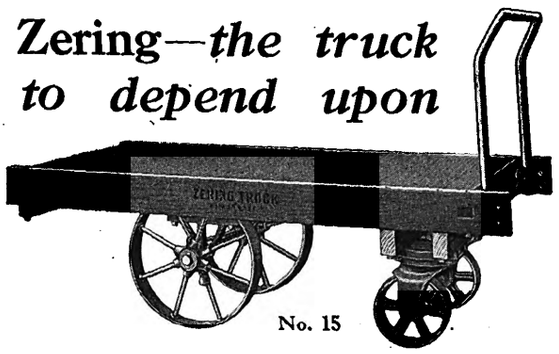
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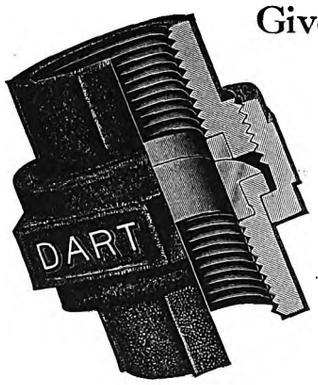
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(*Continued from page* 80)

the sheets are very thin, their insulating qualities are not good.

For roofs of rather steep pitch, concrete tiles have been brought out and are obtainable in fairly large units. Where condensation and leakage of air are not important factors, such as on a boiler house, they can be placed directly on the steel framework of the roof.

Wire glass, made in corrugated sheets, can be used as a roofing material. It is permanent and resists all kinds of corrosive influences and its translucence makes it valuable in certain locations. It is expensive, however, heavy and brittle, and a good conductor of heat. It will not shatter under impact, but of course will crack; and such cracks, unless at once cemented up will let in water. A flexible setting has recently been developed for the purpose of allowing for expansion and contraction as well as wind pressure, which would make it possible to construct a building of glass walls and roof, if such an undertaking were warranted.

Many of the materials mentioned need protection of some kind, especially on flat roofs, where water may stand for some time. On steep roofs, of course, no such precaution is required, as the water runs off readily. Shingles, slate, tile and metals, are able to shed water, relying upon an overlap to prevent rain from working through. Wooden shingles are hardly ever used, but those made of asbestos cement or of felt paper with a stone-chip surface are highly favored. The use of these or slate or tile is determined by the consideration of cost, permanence and appearance. On pitch roofs, metal has been quite extensively employed, the sheets being crimped together at the edges (vertical seams frequently being left standing) and having all flat seams soldered. Copper and zinc are in considerable use, the former being chosen for its permanence, although some opinion tends to a preference for zinc as being equally durable and less costly. While tin is much the cheapest, it must be frequently painted to protect it from corrosion.

Condensation on the under side of a roof, referred to before, occurs where there is a high degree of humidity in a building and in many cases it is necessary to put a layer of insulating material between the structural roof and the outer surface. Prepared cork, fibrous mattings and compressed fibre boards are used.

Where condensation forms on monitor and skylight windows, it can often be diminished by using double glazed sash. Wherever any drip may damage goods or machinery, as for instance in a silk mill, it may be necessary in extreme cases to install gutters to carry off any water that may collect.

Leaky roofs should not be tolerated; nor is it necessary to do so. They are oftener to be blamed on the architect who does not specify in sufficient detail as to material or mode of application, or upon the owner's insistence on low first cost, than upon the contractor who puts the roof on the building. It is simply a matter of using the proper materials and of putting them on properly to obtain a satisfactory roof. After that, roof worries can be reduced to regular inspection and slight repairs for many years.

Flashings, suitably designed, must be placed at all changes or interruptions in the plane of a roof. Flashing should be of permanent and non-corrosive material. It must be set flexibly, especially on wood plank roofs, so that as the wood shrinks, it will not tear the flashing.

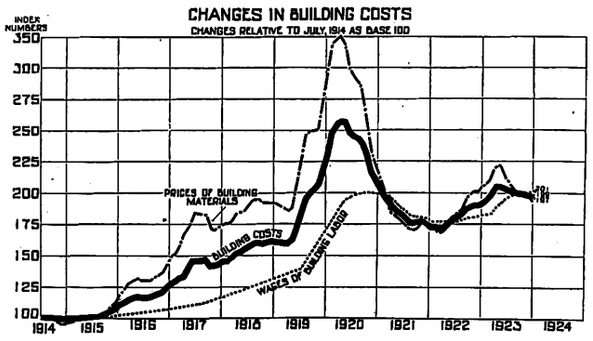
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Finally, flashings should be carried above the highest point to which water might collect before overflowing in case the drains are stopped up or are too small. They should therefore be carried up as high as the "crown" of a flat roof, or to the level of an emergency overflow, such as "weep holes" extending through the parapet walls.

A very important detail of this subject is the removal of rain water from a roof. On roofs of steep pitch, this takes care of itself. Gutters are placed along the eaves to avoid washing out the ground underneath, to prevent the curtain of water from the roof being blown against walls and windows and to get the water away from the building that might otherwise leak into the basement.

It is not so easy to care for the water that collects in valleys and on flat roofs. No hollow spaces must be allowed on the roof unless provided with a drain, and the inlets to these drains must be sturdy, properly put in, and so designed that they will not become clogged by ice or any foreign substance. The drain pipes should be carried down inside the building to avoid their freezing and should be large enough to carry off the largest probable rainfall.

BUILDING costs in the United States, in the midst of what economists have agreed is the country's greatest construction boom, have doubled in the last ten years, according to an announcement issued by the National Industrial Conference Board of 10 East Thirty-ninth street. In its announcement the board summarized the results of a study it has been making into the national building situation. A noteworthy development by the study is that costs of labor and of materials stand at



exactly the same increased levels, for the first time since 1920.

The general trend of building costs, taken as a whole, as shown by the National Industrial Conference Board's survey, is a tendency downward for materials, and a rising tendency in wages. There was nothing adduced in the survey to indicate appreciable reductions in building costs in the near future, conditions in the United States as a whole being considered.

Results of the survey will be made known to the thirty-odd industrial associations for which the conference board acts as the research agency.



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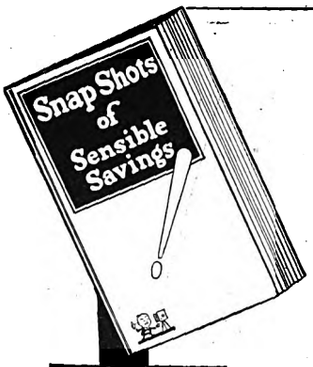
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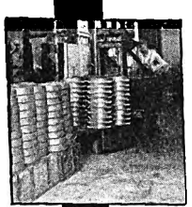
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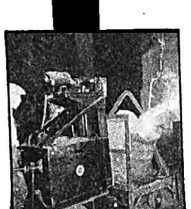
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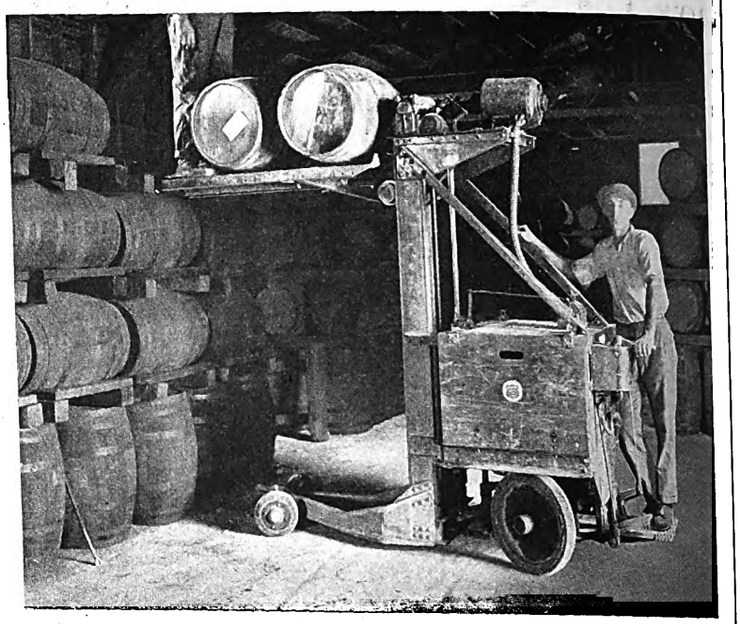
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How They Solve Their Packing and Shipping Problems

(*Continued from page 26*)

building who makes out a bill of lading in quadruplicate. Freight rates are then computed and the bills-of-lading are then distributed. Lists are made of all bills-of-lading issued and sent to the transportation department. The second copy of the bill-of-lading is given the railroad representative, who makes out duplicate waybills from it, the original of which is delivered to the railroad with the freight and the copy being filed in the local freight office. The third copy of the bill-of-lading is filed according to destination, and the fourth copy is sent with a memorandum of shipment to the consignee.

After the bill-of-lading has been made out, the order is priced and then passes to the billing division where a memorandum of shipment is made out. One carbon copy of this memo is kept in file while the original, made out in hektograph ink, constitutes the foundation for the billing and other records. From this master copy is made one copy for the district sales office, one or more copies for the customer, and the master copy is sent the accounting department. Additional copies of the memorandum of shipment are made, one being sent to the district office and another being attached to the bill-of-lading for forwarding to the consignee, the memo first being checked against the bill-of-lading. The extended bills, having been numbered, are mailed or otherwise distributed. The order is then filed.

This routine, however, applies only to shipments made from stock. In case material has to be made up, instead of being obtained from the warehouse it has to be manufactured in the factory. The shipping department receives all orders and distributes copies to the various manufacturing sections. The originals are retained in the shipping department file and the progress of work in the factory up to the point of shipment is noted on the card record. When material is completed in the factory it is then delivered to the shipping department, the routine functioning from then on as already outlined.

But there is another side to the operations of the shipping department whose importance cannot be underestimated. The packing and loading of large apparatus for domestic shipment often presents difficulties owing to weight or clearances, and in many cases special cars are necessary. On the other hand, the smaller pieces usually need only to be carefully boxed to insure their safe delivery to any point in the country. With foreign shipments the problem is entirely different. The shipping department must inform itself of the methods of transportation to be encountered on the journey and of the climatic conditions of the country to which the apparatus is shipped.

As an example, electrical machinery for the west coast of South America must be packed differently from that destined for the east coast. Machines for the west coast must be "dismembered" into numerous small packages of comparatively light weight, because there are no wharves, piers or docks worthy of mention on the entire west coast. Besides this, a burro cannot carry up into the Andes Mountains a package weighing over 170 pounds, while a mule's limit is 350 pounds. Electrical machinery, therefore, must be disassembled before being sent on such a journey.





"Finished in half the time"

George Mirhoff has to sweep out one entire floor of an immense wholesale house every morning. Recently, his concern standardized on Lay Metal Case Brooms.

According to George,—"—the fibre can't break at the shoulders when I knock it against sharp corners, the brooms never drop any straws, and this big, wide sweeping-tip helps me finish the job in half the time."

We make a special broom for every industry and fully guarantee each one. Our new price list is ready to mail. Where shall we send your copy?

The Joseph Lay Company
120 College Street
RIDGEVILLE INDIANA



Cambridge Electrical CO^2 Recorders Indicators

Four Independent Readings from Four Boilers on ONE Chart

are afforded by the Cambridge instrument shown above. This feature makes it the logical choice for the busy boiler room. By showing four CO_2 percentages on one chart time is saved and the possibility of errors in reading is greatly reduced.

Cambridge Electrical CO_2 Recorders and Indicators are extremely accurate and rapid in action and practically fool proof. They are entirely electrical —no chemicals to renew—no glass or rubber parts to break or wear out. These rugged instruments may be installed any distance from the flue. Maintenance cost is very low.

Other Cambridge Instruments—Electric Distance Thermometers, Thermo-electric Pyrometers, Optical Pyrometers, Pressure Recorders, Draft Gauges. Write for List No. 157F, containing interesting data.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC)

MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

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Shipping department experts know how to pack machinery to defy breakage, rain and moisture. In some cases where machinery is destined for the west coast of South America, the boxes are lowered into lighters to be taken ashore. The size and weight of packages must be so limited that the men handling the derricks are able safely to land the machinery in the lighter without running the chance of crashing through the bottom into the sea when the lighter rises on the crest of a wave.

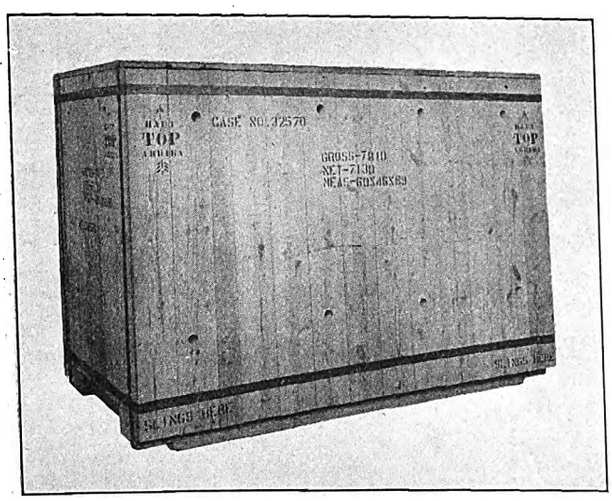
In India, crude trucks drawn by oxen carry loads as heavy as three to five tons and the elephant can haul ten tons. In one installation of American machinery, one year was required to carry the apparatus 250 miles into the interior by elephants.

Electricity is needed in the frigid zones as well as in the torrid zones, and the dog of the Eskimo is the accepted means of transportation in these northern latitudes. One thousand pounds is the limit in weight of each package in order that it may be effectively handled by a standard dog train. So well does the shipping expert comprehend the peculiar local conditions, that special horns are provided on each package to assist the natives in lashing the packages to the sleds.

To illustrate the development of the art of shipping, it might be well to mention that a special train was necessary to transport the first great turbine built from Schenectady to Chicago in 1902. This was a 5,000 kilowatt machine as contrasted with machines of over 60,000 kilowatts capacity which are handled today.

The shipping department has available special cars of unusual strength, with increased depth reaching down to within a few inches of the rail and otherwise adapted for the peculiar variation in size, shape and weight of modern electrical machinery.

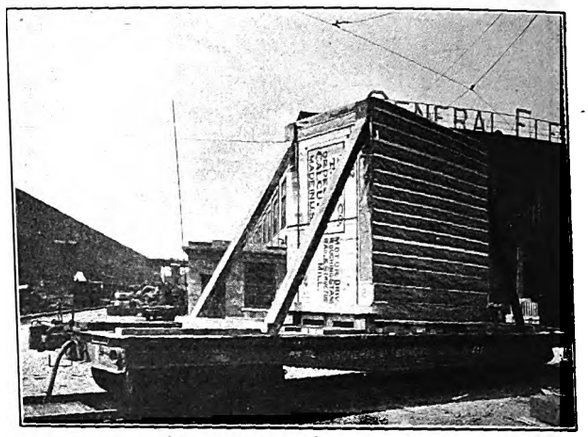
The art of fastening large pieces of apparatus to a freight car has been developed to a high degree of perfection. In one wreck on a western railroad, the car containing General Electric apparatus was upset. When the wreck was cleared, it was found that the platform of the car and the apparatus were still a unit, the platform having left the trucks but remaining fixed immovably to the apparatus.



Note the strength, and the attention to important details, in packing this welding machine for export.

In the shipping department boxes are made and nails driven by electricity. Over a ton of nails is used every day for this purpose. Over eighteen million feet of lumber is used every year and almost 2,000 miles of band iron to strengthen the boxes. About twenty million square feet of wrapping paper, waterproof paper and rubber-covered lining are also required for a year's work.

Many instances could be given where single turbines have required twenty-three separate cars for shipping, where special cars carrying 100 tons each have been utilized and of apparatus so nicely poised and balanced on a car that clearance between the sides of tunnels or bottom of bridges has been figured out to a half-inch. In such calculations as these, it is necessary to abandon the use of wood for boxing, substituting sheet metal to obtain a covering thin enough to avoid crashing into bridges or scraping the sides of tunnels, as either occurrence would probably wreck the entire train.



This well-protected Armature is on its way from Schenectady to far off India.

In the case of shipments for France, Japan, and, as a matter of fact, most foreign countries, the bridges and tunnels have smaller capacities than those in the United States. Conditions in South America are the same. The usual method of packing, skidding, etc., must, therefore, be altered in such cases.

The loading of cars must also be made permanent. The creeping of the load on a car must be prevented. The bumping and rolling of a railroad train has been found to loosen the struts and braces unless the work is well done, and occasions have been known where the trains have been wrecked, bridges damaged and tunnels jammed with a tangle of machinery, locomotives and freight because a packer did not know his business. One of the means of preventing shifting of the load on a railroad car is to load the car uniformly, not only longitudinally, but laterally. The struts and braces are placed with great skill to prevent a concentration of the load at the end, the center or on either side of the car.

In an effort to keep machinery in an upright position throughout an entire voyage, large black arrows are painted on all four sides of a box with the word *Top* placed permanently near the head of the arrow, as well as the French word *Haut* and the Spanish word *Arriba*.

Expert packers have no difficulty in protecting machinery from rain and snow, wind and heat or from the mist on the sea. The real study, however, has been to overcome the accumulation of moisture on machinery due to humidity, especially in the tropics. Rain and snow are excluded by tar-coated building paper strengthened by mosquito netting. This latter is useful in adding strength to the tar paper and serves the purpose admirably.

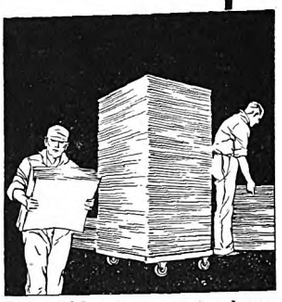
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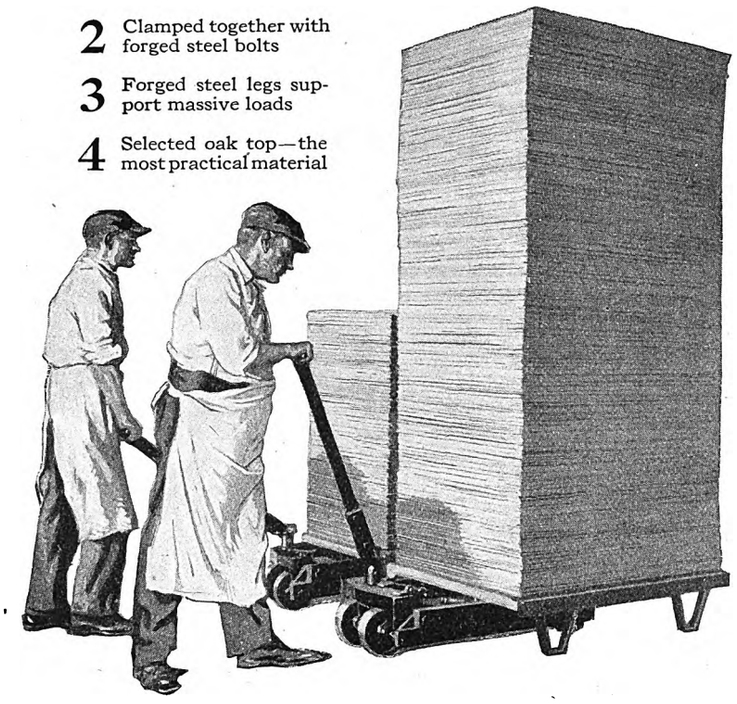
1,000 reasons why U. S. Playing Card Co. uses Stuebing *"Steel-Bound"* Platforms!

Four Notable Advantages

1. "Steel-Bound" the full length
2. Clamped together with forged steel bolts
3. Forged steel legs support massive loads
4. Selected oak top—the most practical material



Before lift trucks were invented, materials were handled more than hauled, and even today, where old style trucks are still in use, handling costs constitute the greater part of "hauling costs"



The only genuine "Steel-Bound" Platform is made by Stuebing. All others are infringements and are liable to prosecution under Stuebing patents

In the plant of the U. S. Playing Card Co., at Norwood, Ohio, are 1,000 "Steel-Bound" Platforms. They are busy every hour of the working day, loaded with *tons* of cardboard as it moves through the plant in course of manufacture.

Why does the U. S. Playing Card Co. use Stuebing "Steel-Bound" Platforms?

Because they know from experience that these steel-sheathed "gluttons for punishment" stand up and deliver under all kinds of use and misuse.

They made long, hard tests with various platforms in order to determine upon the *one platform that would save them the most money.*

And 1,000 "Steel-Bound" Platforms in use, to date, is pretty good proof that they have made a decision!

If you want to make all the saving possible, with *your* material handling equipment, specify Stuebing Lift Trucks and Stuebing "Steel-Bound" Platforms. Write today for a copy of our new 36-page catalog.

THE STUEBING TRUCK COMPANY
Cincinnati, Ohio Cornwall, Ohio
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StueBing
LIFT TRUCK SYSTEMS

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NO OTHER LIFT TRUCK IS BUILT LIKE A STUEBING!

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8000 Factories Use Meeco Coolers

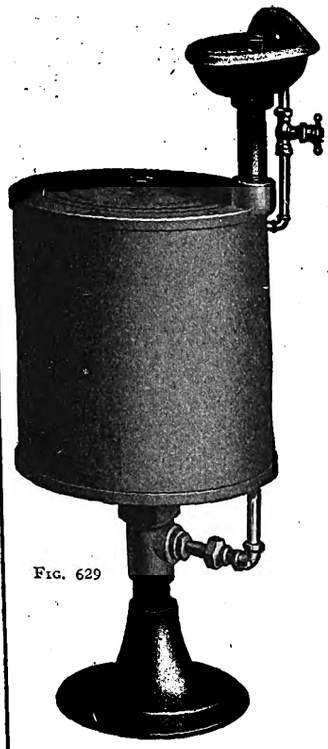


FIG. 629

LEADING industrial concerns throughout the United States and abroad have endorsed MEECO COOLERS not only because they were the pioneer coolers, but also because they have demonstrated their durability and dependability over a long course of years. No MEECO COOLER has ever worn out. Many have done steady service for from twelve to fifteen years. There is no guesswork about their lasting qualities. They have been time-tested.

MEECO COOLERS are backed by nearly twenty years' experience in design and manufacture. They naturally embody many unique and exclusive features:

The Keith Sanitary Bubbler is standard equipment on all MEECO COOLERS. This bubbler is automatically, internally regulated so that a steady bubble may be maintained at a fixed point, no matter how the water pressure may vary. The adjustment of this permits fixing the height and force of the stream so as to prevent placing the mouth in contact with the bubbler. The size of the stream is just right, not only for good service, but for economy of water. The surface is convex and is automatically washed both before and after using. An upright or slant stream is optional.

The Meeco elliptical-shaped guard bowl and slant stream bubbler can also be furnished on all types without extra charge.

Meeco Coolers are heavily cork-jacketed on top, bottom and circumference in order to insure the utmost economy of ice. The coils are of the best quality ½" seamless, drawn, copper tubing, approximately 55 ft. long in 15½ coils. The water from the melting ice circulates freely around the coil in the quick cooling process, but does not come in contact with the drinking water inside the coil. The tank and coil capacity is scientifically designed to furnish water sufficiently ice-cooled to supply a continuous procession of persons such as is customary under practical conditions. The tank is constructed of heavy welded iron, galvanized after fabrication, and leakproof. The bowl is cast iron, pure white vitrified porcelain-enameled on the inside. The self-closing stop valve and other small fittings are of heavy brass, nickel-plated. The coolers are handsomely finished in two coats of olive-brown enamel, baked on.

There are 14 types designed for every need (Diagrams and complete details of construction will be mailed upon request). MEECO engineers, because of long experience in studying cooling requirements, are in a position to recommend the scientifically correct fountain for your particular requirements.

Due to quantity production, the cost of MEECO COOLERS is lower than you might expect. May we send you prices?

Sanitary Washbowls *Lockers*

METAL MEECO PRODUCTS

Shelving *Stools and Chairs*

MANUFACTURING EQUIPMENT & ENGINEERING CO.

FRAMINGHAM, MASS.

136 Federal St. Boston — 4735 Grand Central Terminal New York — 1338 W. Lafayette Blvd. Detroit

(*Continued from page* 86)

For packages that go to foreign countries an additional covering of what is known as carriage cloth is used beneath the covering of tar-paper. This cloth is wrapped around the machinery itself and is held tight by strings and ropes that the machinery may be well protected no matter what position it assumes.

Various experiments were tried to overcome damage from rust produced by moisture in the air, or humidity. Special kinds of cloth and special coatings of tar were used and, in some cases, an entire metal box of zinc or lead was constructed and apparently hermetically sealed. All these methods failed, however. In one instance a motor was totally enclosed in a zinc tank and soldered tight. Two years later it was opened and three quarts of water were found in the bottom of the tank.

The problem was finally solved by making the boxes open instead of closed, in other words, breathing holes were provided to keep the temperature inside the box practically the same as that outside. After many experiments, a method was developed which solved the problem. Machinery was delivered free from rust but, in one instance, it was found that the mice on shipboard had taken advantage of the breathing holes in the boxes and had eaten off the insulation from some of the copper wires. From then on a wire screen or netting was tacked on the inside of each hole. Moreover, these holes must be far enough away from the top, bottom or sides to avoid the possibility of water washing into them.

As contrasted with these methods for large machinery, in the case of smaller and more delicate apparatus such as instruments which are liable to damage from moisture in very minute quantities, a pitch-covered canvas is used inside the box.

Each type of apparatus has assigned to it a definite box, of definite size and material, put together in a certain way, wrapped, tagged, etc., according to definite specifications, written down and often illustrated. There are over 700 kinds of boxes listed, and directions are included covering many different methods of loading flat cars, in which are specified the braces, struts, skids, etc., which should be used.

A summary of the ideals toward which the packing experts strive, in the order of their importance, might be as follows:

1. Get shipment to customer without breakage.
2. Get shipment to customer without rust or other damage by moisture.
3. Deliver shipment as nearly completely assembled as possible.
4. Deliver shipment as quickly as possible.
5. Deliver shipment with as small a transportation expense as possible.

Erratum Notice

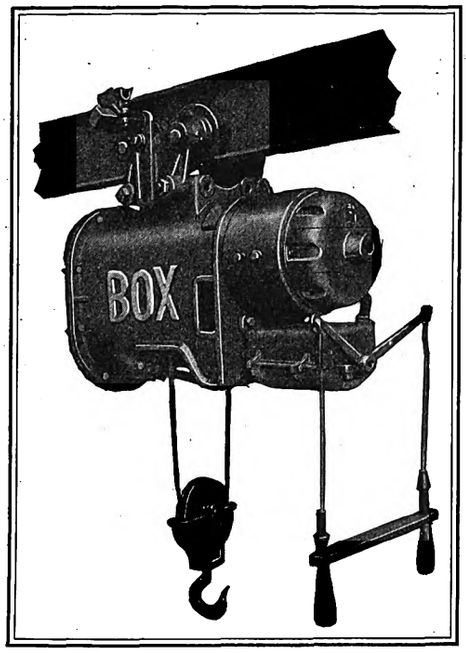
In our March, 1924, issue, photographs (Figs. 8 and 9) shown on page 19, illustrated the use of Van Dorn Iron Works' dump bodies on motor trucks. In the text on page 22, the impression was conveyed that one of these devices was mechanically operated, and the other hydraulically operated.

We wish to correct the statement on page 22, as both these dump bodies are mechanically operated.

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They Still Stick to Man-power



Alfred Box & Co., Inc., are also builders of the "Box Crane"—a standardized, heavy duty, Electric Traveling Crane in capacities of twenty tons and under; also builders of hand operated Traveling and Jib Cranes of any capacity. In addition, full line of Electric Hoists to five tons capacity—embodied in which are all the important features found in the "Load Lifter."

The Oriental idea regarding man power is not practical in this Country—yet we find many industries still allowing two, three, four, often five men to lift and shift parts, when *one man and an electric "Load Lifter"* would do the work quicker, better and cheaper than is possible with expensive and inefficient man power.

* * *

Every business which has loads up to 500, 1000 or more pounds to lift should be "Load Lifting" them—cutting costs, increasing outputs and doing a bigger, better day's work. The "Load Lifter" is small in size, but very powerful. It is of rugged construction—made to give years of hard service. All parts are enclosed and built with it are features that have made the name BOX on lifting appliances internationally known.

Do not let another day slip by without sending for information we have ready to send you, on lowering lifting costs and taking man-lifting from your business. On request, it will be sent to you by return mail.

ESTABLISHED 1876

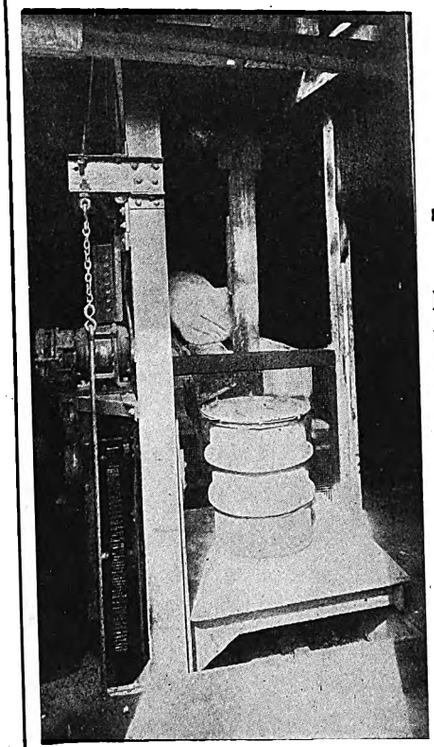
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BOX CRANES

2204 E. Ontario Street Philadelphia, Pa.

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DELTA
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Registered Pat. Off.

Hand and Electric Portable Elevators to handle Boxes, Barrels, Crates, Bales, Etc.

Ask for catalog 105 and let us show you the time and money saving features of the DELTA.

Unit Machines for fixed position use, make easy handling to mezzanines, etc. Any capacity, platform, size or speed.

New Jersey Foundry & Machine Co.
90 West St. New York

Is There a Materials Handling Industry?

(*Continued from page* 36)

ing of straight run conveyors. The various types employed are *push bar elevators* for raising the boxes to the *gravity conveyors* that carry the boxes over the marshes from the plant, *belt conveyors* that transport the boxes the length of the dock, and the *crane* which carries the *spiral chute* which lowers the boxes into the hold of the ship.

The above equipment saves thousands of dollars per year and renders an economic service. It also permits quicker loading of the ships which receive their cargo from this plant. What is true here is true in other plants, but we wish to point out that in this installation only one class (although many types) of materials handling equipment is employed, but if the operation had been such that more than one class of equipment was required then it would have been necessary to work with more than one manufacturer and to employ an engineer conversant with all types and classed so as to avoid difficulty, as the manufacturers have not yet learned the full meaning of coöperation.

Because so many new uses are being made of mechanical equipment for the handling of materials, there is hardly a week or month that passes that does not bring forth a new development in order to handle a particular operation for one or more industries. Sometimes these devices can only be used on the operations they were designed for, but more often they can, by slight alterations, be used on many operations, and in different industries.

A device of the above character is shown in Figs. 11 and 12 and many installations of this bread cooling conveyor are now being made in both old and new bakeries. The writer is not aware that this device is being used for any other purpose than bread cooling but its construction and slow motion should suggest many uses. The discharge from one run to the other is clearly shown in Fig. 12 and the direction of travel is indicated by arrows. It will be noted that all the runs are carrying runs and there are no idle return runs.

The manufacturers who have been called upon to develop the most numerous new models of their equipment for special operations are the electric storage battery truck manufacturers and some of these models are shown in Figs. 15, 16, 17 and 18. This branch of the industry started out with one or two models or types of equipment, namely the electric lift truck and the electric tractor, but today each manufacturer has a number of models and these are only a few of the more recent ones.

The model shown in Fig. 15 is a heavy duty, revolving crane which is transported and operated entirely from electric storage batteries. The machine shown in Fig. 16 is a standard type high elevating truck equipped with a special platform, and finger gripping device for the handling of sheet stock. This truck attachment was developed for the handling of sheet tin, but there is no reason why it cannot be used for handling sheet metal, sheet paper stock, etc. The advantage of this truck over the ordinary high elevating truck is that with the attachment, the use of a number of skids or platforms is un-

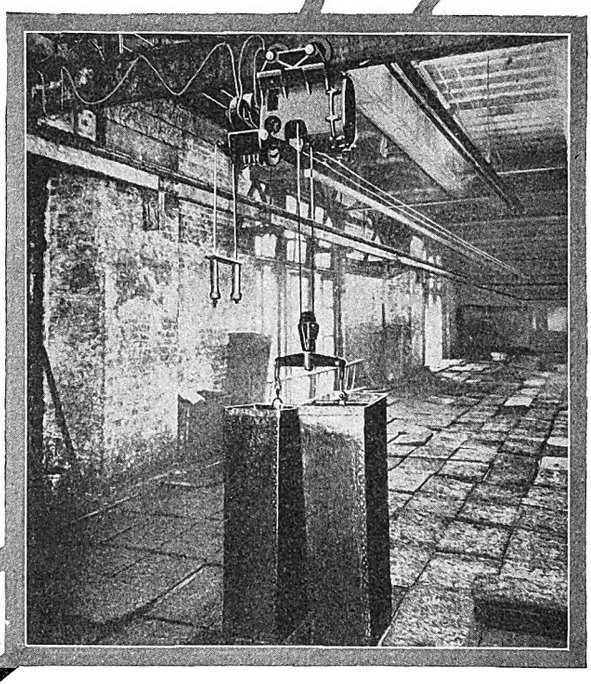
(*Continued on page* 92)

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Cheaper Handling

Machines Every Manufacturer Should Investigate

FOR loading loose material such as coal, sand, gravel, etc., or for lifting and transporting heavy products about your plant, these two Link-Belt Machines not only save in wages and time, but afford notable economy in equipment costs at the outset.



The Link-Belt Electric Hoist

The Type C-½ hoist will effect pronounced economies in the smallest or largest plant. Once in operation it replaces a surprising amount of labor, and handles your materials with a quickness and dispatch not otherwise possible.

Type C-½, Price $270 Complete

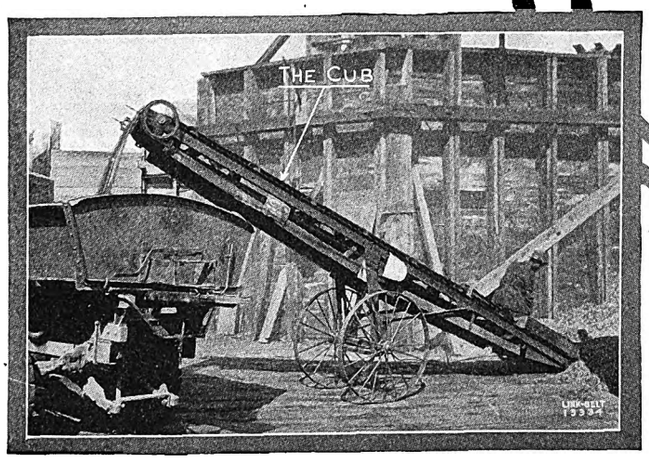
F. O. B. Chicago or Philadelphia

The C-½ will lift 50, 100, 500, 1,000 pounds. It is built *to give* years of service. Anyone can operate it. The price includes complete equipment, ready for work when you get it.

Make Overhead Space Pay Profit

The Link-Belt Hoist saves floor space. It takes the shortest route from point to point. Handling confusion is eliminated. It is quick, unfailing in its operation and amazingly economical.

Send for book No. 480



The "Cub" Portable Loader

Handles any loose material—45 cubic ft. per minute, equivalent to the work of six or more men, to be exact.

Price $485 Complete

F. O. B. Chicago or Philadelphia

The price includes all necessary equipment. The unit is complete, ready for work, when it arrives.

Send the coupon below for interesting suggestions on how the "Cub" loader or Electric Hoist may save in your work.

Send Coupon for Information 1677

LINK-BELT COMPANY
2045 HUNTING PARK AVE., PHILADELPHIA

☐ We are interested in the Link-Belt "Cub" Portable Belt Conveyor at the new low price, F. O. B. Chicago or Philadelphia—$485. Please send us full particulars.

☐ We are interested in the Link-Belt C-½ Electric Hoist, at your new low price of $270, F. O. B. Chicago or Philadelphia. Please send further information.

Name_____ Firm_____

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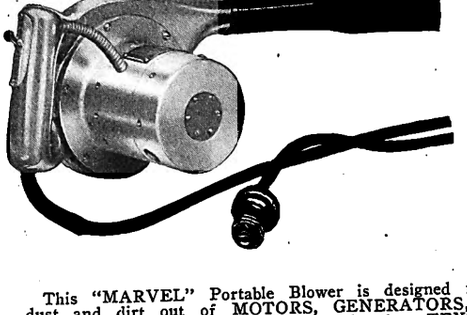
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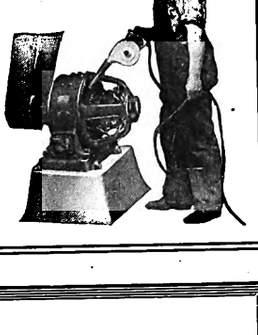
$40.00 Net

This "MARVEL" Portable Blower is designed for blowing dust and dirt out of MOTORS, GENERATORS, SWITCH BOARDS, LOOMS, KNITTING and other TEXTILE MACHINERY, as well for GAS BLOW PIPES, GAS FURNACES, ETC. Has 20 feet high grade cable and armored plug. Perfectly balanced. Has TOGGLE SWITCH in handle, operated by thumb. Gives 16" water column pressure.

Note the Metal Conduit carrying wires from motor to handle.

Motor operates at 10,000 R.P.M. on New Departure BALL BEARINGS. This Blower is a great time and labor saver, and its mechanical and electrical design gives assurance of a very long life, with a minimum of attention.

Made with UNIVERSAL motors (A.C. & D.C.) for both 110 volt and 220 volts. SHIPPING WEIGHT 18 lbs. Shipped on 10 days' trial, ANYWHERE.



Shipped on 10 Days Free Trial.

MANUFACTURED BY

ELECTRIC BLOWER COMPANY

352 Atlantic Avenue
Boston 9, Mass., U. S. A.

Just Suppose--

You had coming to you every month a big bunch of Pictured Progress such as you see in this copy of

INDUSTRY ILLUSTRATED

Wouldn't you give it a hearty welcome?

Wouldn't it put a dash and a sparkle into the daily grind you have always wanted—but which you have found hard to get?

And *wouldn't* it be worth to you many times what it costs?

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Engineering Magazine Co.,
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SEND ME INDUSTRY ILLUSTRATED every month for a year. I shall remit when your bill comes—sometime within the next thirty days.

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(Important confidential information—for our own records only)

ANNUAL SUBSCRIPTION $1 Foreign, excepting Canada, $1.50

(*Continued from page* 90)

necessary, for the placing of the materials on 2" strips as shown will permit the truck to pick up the load without rehandling. The truck shown in Figs. 17 and 18 is bringing out a new principle of picking up the load by getting around it instead of under it. When handling loads similar to that shown, this method of pickup has many advantages. Attention is directed to the simplicity of the adjustment on the lifting arms so as to permit the pickup of different diameter reels.

This indicates that it is the present manufacturers who should investigate all new handling problems and then adapt their present equipment to fit the job or else develop new equipment. The following of this practice will assure them of a continued business and will discourage the springing up of a number of manufacturers to build special materials handling equipment. Many new devices are offered to the present manufacturers and are turned down without due consideration and the result is that if the inventor has money or can interest capital he will produce his device by forming his own company. In this way a number of the present manufacturers obtained their start and because of their progressive spirit have added new developments to their original line and are now considered the best in their field.

It is therefore necessary for each manufacturer to be continually on the lookout for new ideas and new uses for his present equipment, either in its original state or with additions and alterations. Fig. 13 shows how a tiering machine manufacturer used the principle of his original equipment and fitted it into a fixed machine operation. Fig. 14 illustrates how a tiering machine, which was primarily built for piling materials, is now used for the loading and unloading of trucks.

When an operation such as the unloading and loading of trucks is considered important enough there is always a machine developed and patented to execute the work. To prove this we present Figs. 19, 20 and 21, which show the operation of a new elevating end gate. This device is a part of the truck and is driven direct from the truck engine. This feature means that the elevator is with the truck, whether it is in the plant, at the station, or on the road. Thus it is always ready to load or unload the truck at a moment's notice. The elevating operation is clearly shown, but Fig. 19 illustrates a use for the same equipment which presented itself after the machine was built and installed on the truck. The feature of being a power driven jack will add to the value of this device for the truck user.

At the first part of this article reference was made to the Automotive Industry and it will be noted from the illustrations that this industry is directly affected by the use of materials handling equipment. In fact a motor truck is one of the many pieces of equipment that would come under this heading, and it will be noted from Figs. 22, 23, 24 and 28 that this industry is already cognizant of the importance of adapting the equipment it manufactures to the many operations which it is called upon to perform.

Figs. 22 and 23 show a device which a large truck manufacturer is now building and selling to work in conjunction with his trucks. This machine is equipped so that post holes can be dug mechanically by using power from the truck engine, and the crane device simplifies the setting of the posts. The construction of pole lines

(*Continued on page* 94)

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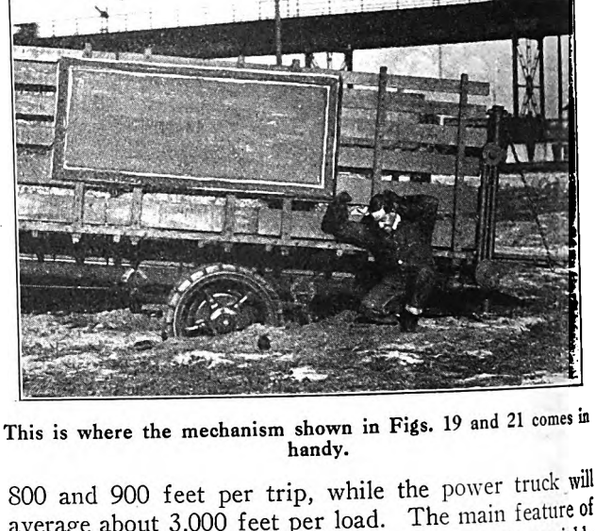
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(*Continued from page* 92)

for a telephone or telegraph system embodies a variety of work and especially on long stretches of country roadside which requires the transportation and maintenance of big gangs of men, and because men dislike this sort of labor, and speed is the greatest essential in repair and replacement work, a device as shown will materially reduce costs and bring about the desired results.

Another indication of the trend of the Automotive Industry, in regard to materials handling, is shown in Figs. 24 and 28, which illustrate a new type of motor truck that can be either electrically or gasoline driven. This equipment straddles the load and in this way eliminates rehandling. It has been found that one of these carriers operating in the plant of the Lamb-Fish Lumber Co., Charleston, Miss., replaced 10 mules and 10 men, which of course is quite an item. It was also found that the new carrier would handle from 150,000 to 200,000 feet of lumber in 10 hours, while the average for a team is 15,000 feet in 10 hours. The figures collected also show that a man and a mule handle on the average of



This is where the mechanism shown in Figs. 19 and 21 comes in handy.

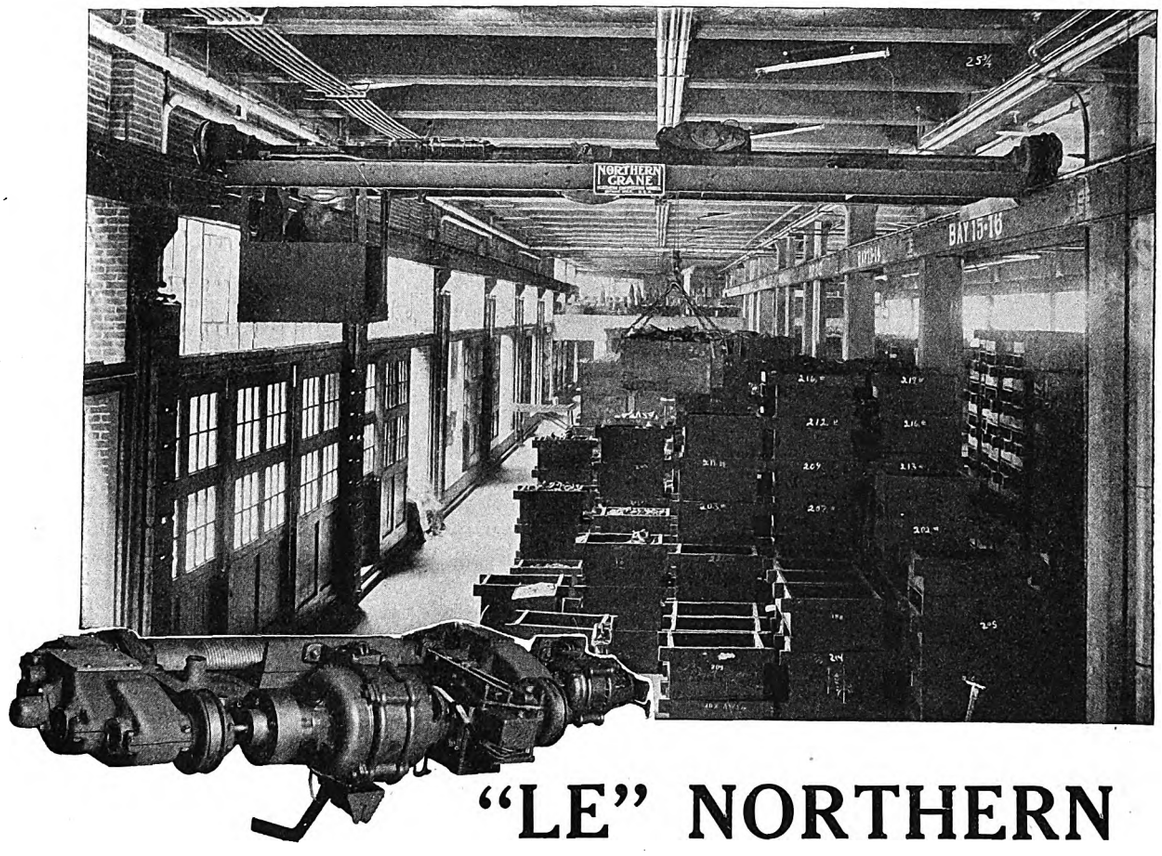
800 and 900 feet per trip, while the power truck will average about 3,000 feet per load. The main feature of this truck is its ability to pick up long and unwieldy timbers, as shown in Fig. 24.

It is not only the automotive industry that is bringing out new types of equipment, but others are also entering the field with many new devices. Figs. 25, 26 and 27 show one of the latest developments in the mechanical driven conveyor field. This machine is new and novel and while still in a more or less development stage, it is being produced and sold. This device was evolved to supply the need of a conveyor, mechanically driven, that would be capable of operating around corners. To the writer's knowledge this is the only portable flexible power driven conveyor that is on the market at the present time. This is therefore a new departure, and a radical development. There are, of course, gravity conveyors and gravity spiral chutes which will convey materials around corners, but it is not always convenient or possible to use gravity as a means of locomotion and gravity will only convey the materials in one direction, while with a power conveyor it is possible to convey in both directions.

With this flexible conveyor it will be possible to trans-

(*Continued on page* 96)

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The CRANE for Low Headroom

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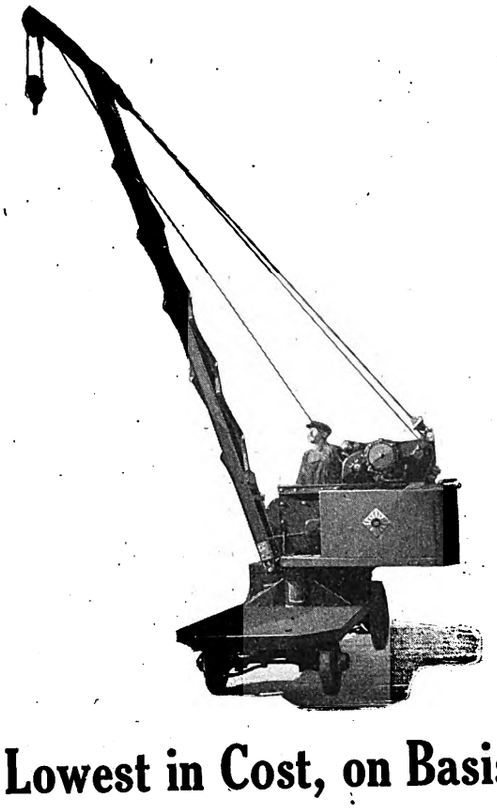
fer from one location to another such materials as boxes of all ordinary dimensions, sacks, kegs, pails, lumber, pig iron, bricks, slabs and all similar materials. This equipment can also be used for loading or unloading box cars or to simply stack materials to reasonable heights in warehouses and other places. The power required to operate these conveyors is said to be extremely small; a 1/3 H.P. motor operating 42 feet in a horizontal run.

If we consider all the types of equipment that are here shown and then realize that these are only a few of the many that are now being manufactured, we can begin to realize what Materials Handling means and the possibilities of duplicate effort on the part of a good many manufacturers. Because of the widespread interest in the subject it seems pertinent to ask the question, "Is There a Materials Handling Industry?" The answer at this time is "No."

Nevertheless, considering all the present manufacturers who are devoting all their energy and plant facilities to the production of this equipment there are the best indications that at some future date such an industry will evolve. It will be agreed that no type of materials handling equipment is sufficient to perform all the operations necessary, and by no stretch of the imagination would it be possible to produce all types and classes of this equipment within one plant. It will, therefore, be seen that before we can have an industry it will be necessary to bring about a coördination of manufacturers.

Why is it necessary to depart from the present method of handling the business of manufacturing and selling materials handling equipment? This question is also a large one and is placed here more to set executives thinking than for the sake of argument. Let us consider the problem of the average industrial plant executive who has read considerable about the inefficiency of methods of handling materials and who might be already aware that all this applies to his own plant. At the present time he might firmly resolve to remedy these conditions, in so far as they pertain to his plant, but he will be unable to act until he has made a thorough study of the present equipment with the view of selecting that equipment which is best adapted to his peculiar requirements. If he calls on any of the manufacturers, he finds them limited in their scope and endeavoring to equip his plant with only the types of equipment that they can furnish and frequently he finds himself in the position of an engineer trying to make up a comprehensive plan using one or more types of equipment. Because of his lack of knowledge, and the inability of the manufacturers to help him he gives up in disgust or only installs a part of the equipment that is really needed.

It has been pointed out that the Automotive Industry has a well organized system of distribution, sales agencies, and service stations and the writer feels that a better and more complete system of the above points will have to be developed for the materials handling manufacturers. It will only be a few years before the plant executives will demand a more intelligent study of their problem before they will invest thousands of dollars, and this demand from the consumer will do much to develop, what is now a group of individuals, into a real stable industry.



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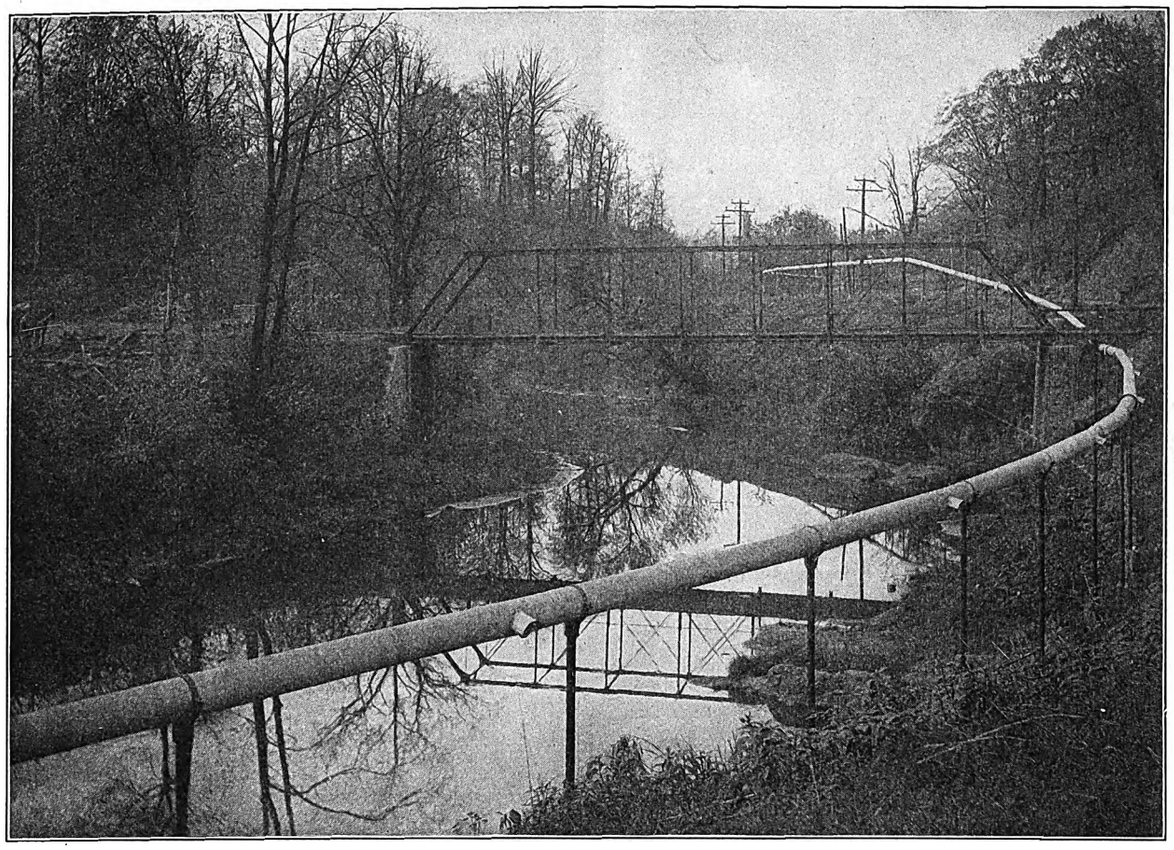
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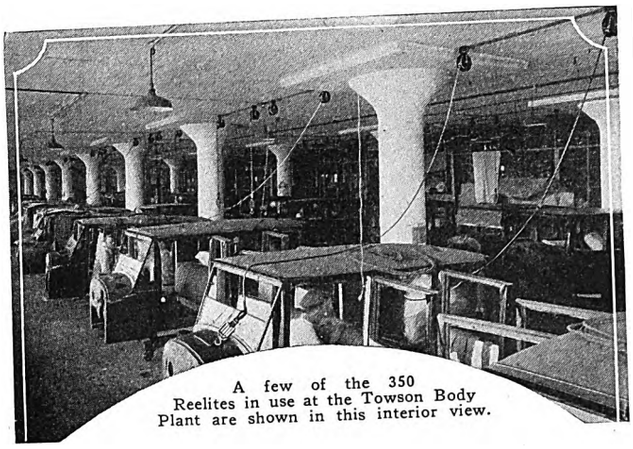
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Maintaining the Electric Lighting System

(*Continued from page* 31)

the plant with correct lighting will have a lower labor turnover. It is very important to avoid direct glare when the intensity of a lighting system is increased. Putting lamps of double the wattage into the same reflectors will double the intensity, but the filament may be visible, causing a glaring effect. Glare causes eye strain with all its attendant evils, and the intelligent manager will give the proper consideration to the eyes of his men, especially as it is to his interest as well as theirs that their eyes be kept in good condition. Under the influence of glare, the pupil of the eye contracts, impairing the sight, but with proper lighting the pupil expands to normal size, allowing correct vision.

The maintenance of the lighting system includes the cleaning of lamps and reflectors and as this work has a very important influence on the lighting efficiency, it should not be neglected. Organized cleaning at regular intervals is the best method of handling this work. The cost of cleaning large steel direct lighting reflectors and lamps averages about five cents per unit. The frequency of cleanings should vary with the class of work done in each department. In even the cleanest of assembling rooms the lighting equipment accumulates a great deal of dust, and at the other extreme, in such places as foundries the dust and dirt will quickly cause a large loss in light and a waste of energy. For each installation it is easy to figure the most economic period for cleaning, considering cost of power, cost of cleaning, loss of light due to dirt and number of hours per day that lamps are burned. In large plants it is usual to have the sanitation department take care of all cleaning, and this subject will be treated in the article dealing with the work of this department.

There are three methods of lighting commonly used in plants: first, the localized lighting; second, general illumination; and third, localized general illumination or group lighting. Local lighting was the first lighting used in plants and it still has its advantages where extremely fine work or deep boring is done. It should always be supplemented with general illumination, as it is very dangerous to have a dark shop with only the few bright spots at the local lights. The men are apt to get hurt by getting caught in belts or gears and are also apt to trip over obstructions on the floor. General illumination using the larger, more efficient lamps is gradually superseding local lighting. With a well designed system there will be no glare, and there will be an even distribution of light. Switches should be conveniently located, and in some cases it will be well to have the wiring laid out so that the middle of a wide room may be lighted before the sections nearer the windows. With low ceilings localized general illumination or group lighting is best, as with this method it is possible to have the light come from the proper direction. As a general rule the power required for a group lighting system is about the same as for a general lighting system. Group lighting gives all the advantages of general lighting and eliminates the disadvantages of local lighting.

When local lights are used on machine tools, elbow

(*Continued on page* 100)

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(*Continued from page* 98)

brackets attached to the machine allow the operator to place the light where it is needed. When drop lamps are used they usually are not in the correct position, because it is hard to get the outlet at exactly the right place. However, this may be helped by placing the outlets approximately in the correct position, and then using an approved cord from the outlet, with a cleat which may be fastened to the ceiling anywhere within a radius of a foot from the outlet. By using this method a drop lamp may be located exactly where needed or it can be moved without disturbing the wiring. Benches along the walls may be well lighted by a row of lamps about six inches in from the front of the bench, and on eight to ten foot centers. The size of the lamps depends on the fineness of the work to be done and varies from forty to one hundred watt lamps. Benches in the middle of the room are well lighted by the general illumination.

In order to have a basis for measuring the value of illumination the foot-candle is used as a unit. A small tallow candle flame has a horizontal candle power of one; therefore, if it is held one foot from a wall it will produce an illumination of one foot-candle on it. This unit is a very easy unit to figure with, and, with the aid of a foot-candle meter, it is possible for anyone to measure the intensity of illumination in any part of the plant. The foot-candle meter is very simply operated, and quickly measures illumination right at the point where the work is being done. For rough machining an illumination of three to six foot-candles is desirable, for medium machining from five to ten foot-candles, and for fine machining from eight to sixteen foot-candles. Complete tables giving desirable intensities of illumination for different classes of work are available from the manufacturers of lighting equipment, and it is a very good idea to check the illumination in the various departments occasionally, to find out if the units are being kept clean and old burned out lamps renewed. A record of foot-candle meter readings taken about twice a month will show the condition of the lighting system at all times, and will quickly show any let-up in maintenance of lamps or cleaning. These records show the results secured from the amount spent for lighting and therefore give the cost per unit of light on the job, and this is the true measure of lighting efficiency. Reflectors that are well designed take into account the size of the lamp and the length from the light center to the socket. Therefore in order to get the best results it is necessary to use the right size lamp in all reflectors.

In order to obtain the maximum advantage from good lighting, the surroundings such as ceilings and walls must be kept clean and well painted. As a rule paint is much cheaper than electricity, so for dirty or dusty plants painting is very important. For plants, white paint is to be preferred because it has a much higher coefficient of reflection than any color. White walls and ceilings tend to diffuse any light falling on them and prevent dense shadows which are not desirable.

Most lighting circuits are 110-volt, but there are many 220-volt systems in use. In planning a wiring layout to save copper a 220-volt system seems to be best, but when all points are considered it is admitted by all that 110-volt systems are best. The filament in a 220-volt lamp is nearly twice as long as the same size for 110 volts. This is a serious drawback. The cost of 220-

(*Continued on page* 102)



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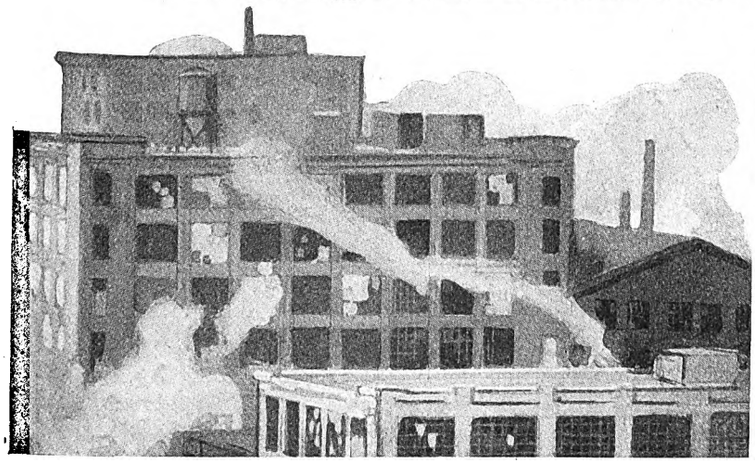
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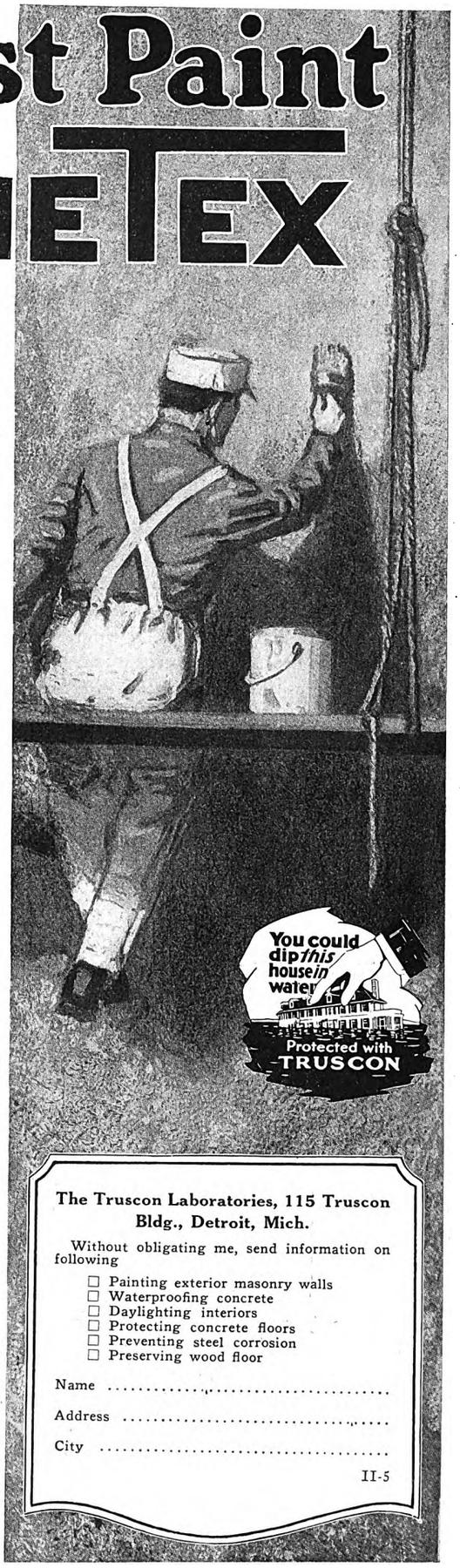
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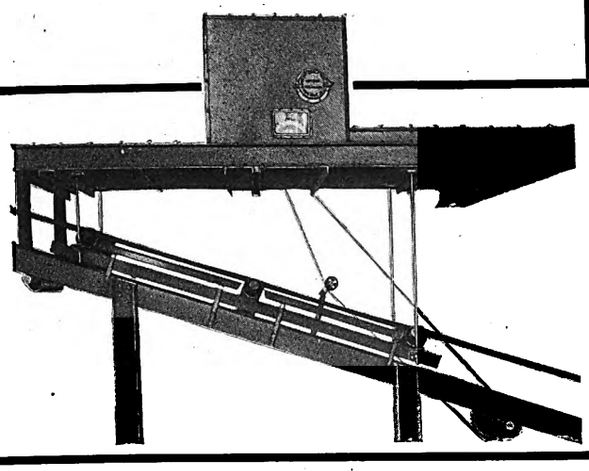
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(*Continued from page* 100)

volt lamps is more than 110-volt lamps on account of more labor and material in the 220-volt lamps due to longer filament and also to the fact that 110-volt lamps are much more standardized and make up nine-tenths of the business of the lamp manufacturers. If alternating current is being purchased and is stepped down to 220 volts it is easy to change over to 110 volt lighting as most transformers have mid-taps which will give 110 volts. If the current is generated in the plant at 220 volts it is necessary to put in a balancer coil and use 3-wire distribution. With an installation operating at 220 volts direct current, a motor generator set or balancer should be used for changing to a 110 volt system. The savings, in any of the systems mentioned, should soon return the money invested to make the change.

The life of lamps is a very important point because the cost of illumination is the cost of the electrical energy used, plus the cost of renewals of lamps. A lamp may be designed to have a very long life but in order to do this it must operate at a low temperature and naturally is not as efficient as one operating at higher temperature. A long lived lamp will reduce the number of lamp renewals but it will increase the cost of light because it will consume more electrical energy. The most economical life of a lamp is the point where the sum of the costs of electrical energy and lamp renewals are the smallest. There is a great deal of variation in the life of lamps so any tests should be made on a large number of lamps rather than on only a few. It is very important that lamps of the correct voltage be used. If the voltage of the circuit is higher than the lamp label voltage, the lamps will soon burn out. If the voltage of the circuit is lower than the lamp label voltage, the lamps will not give their proper amount of light. When the voltage fluctuates it is best to order lamps of a voltage near the average of the fluctuation.

When electric lamps are burned the filament gradually becomes smaller due to evaporation of small particles which are deposited on the inside of the bulb, blackening it and absorbing the light. An average life of one thousand hours is usual before having to remove lamps due to blackening, but many will have to be removed before this. Dust, oil and moisture collecting on the outside of the lamp cut down the light more than most people realize and this accumulation should always be cleaned off when the reflectors are cleaned.

For local lighting such as drop lamps and bracket lamps the mill type lamps are suggested. They have a short stem and flexible supports and therefore have more strength than regular lamps. They are specially made for conditions where lamps are subject to vibration or shocks. With the large lamps used in general lighting it is necessary to protect the eyes of the men from the bright filament when open reflectors are used. The bowl enameled lamp has superseded the bowl frosted lamp for this purpose. The enameling is a smooth coating of white translucent material which can be easily cleaned. It gives much better diffusion than frosting, and does not discolor with heat through use. Many plants have adopted locked sockets or locked guards on lamps in order to eliminate pilferage of lamps. This practice undoubtedly saves lamps but it has the disadvantage of having to send a man from the electricians' department every time a lamp burns out. This may be

(*Continued on page* 104)

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(*Continued from page* 102)

taken care of by a junior electrician, who answers the telephone calls for lamps. Lamps should be purchased in standard packages whenever possible as the prices are usually much lower in this case. Also if possible all lamp purchases should be made on a contract by the year in order to get the advantage of large quantities.

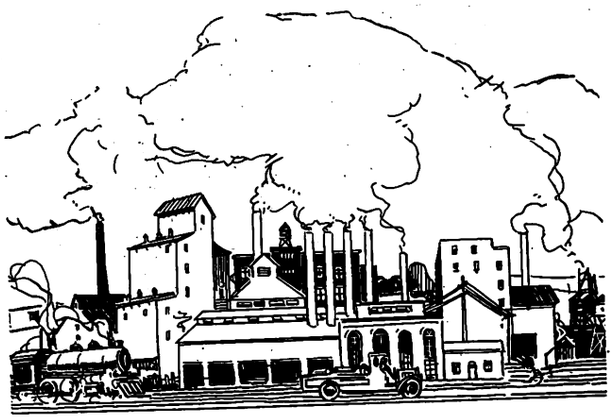
In most plants direct lighting steel reflectors are used for general lighting as these are the most economical units to install and maintain. When more diffusion is needed a similar reflector with a glass diffusing globe is often used. These two types make up most of the installations in the plant proper, but for special rooms or offices the semi-indirect or totally indirect fixtures are desirable. The so-called RLM Standard Dome reflector is being generally adopted for the great majority of plant requirements. RLM Standard is abbreviated from Reflector and Lamp Manufacturers' Standard. These reflectors were designed by engineers from the leading manufacturers and are built to specifications. The quality of the enamel is very important, the surface should be smooth as glass so that it may be easily cleaned and the luster not impaired by scrubbing.

The reflectors on the large general lighting units are easier to clean if they are easily removable so that they may be cleaned on the floor. With a spare reflector and lamp, one trip up the ladder will suffice. When reflectors become chipped they may be painted on the outside and the chipped spots touched up on the inside. These may be used as spares to replace others that become damaged. On overhead general lights it is not generally necessary to put on a wire guard to protect the lamp from breakage, but on drop lights the breakage is apt to be very high, and guards are advisable. They perform the double duty of protecting the lamps from breakage and pilferage.

Sockets on overhead general lights may be keyless, as they are controlled by snap switches on walls or columns, or else pull chain sockets are used so that each individual light may be turned on or off. Pendant switches are also used for controlling overhead lights. However, it is best not to allow individuals to control the general lighting because it is usually necessary to light up at least a section of the room if any light is needed. Key sockets should be used on individual drop lights and bracket lights, and operators should be instructed to turn off the light when they finish work at a machine. Locked sockets are a good investment on all drop lights. In order to get at lamps and reflectors in high ceilinged rooms to clean them and replace lamps the automatic cut-out hangers have been developed. These allow the socket, reflector and lamp to be lowered to the floor, for cleaning, by the use of a lowering rope. No ladders are required and the saving in time and the protection against short circuits as well as the safety of working on the floor instead of on a high ladder are all points in favor of these cut-out hangers. If maintenance of units like this is made easy and safe, it is probable that they will be taken care of more often.

The main switchboxes for lighting are usually near the center of the building, on a blank wall if there happens to be one near that location. The safest way is to have a safety panel in which the live portions are locked up and only the switchbuttons themselves are exposed. These are much more expensive than the regular switch-

(*Continued on page* 108)



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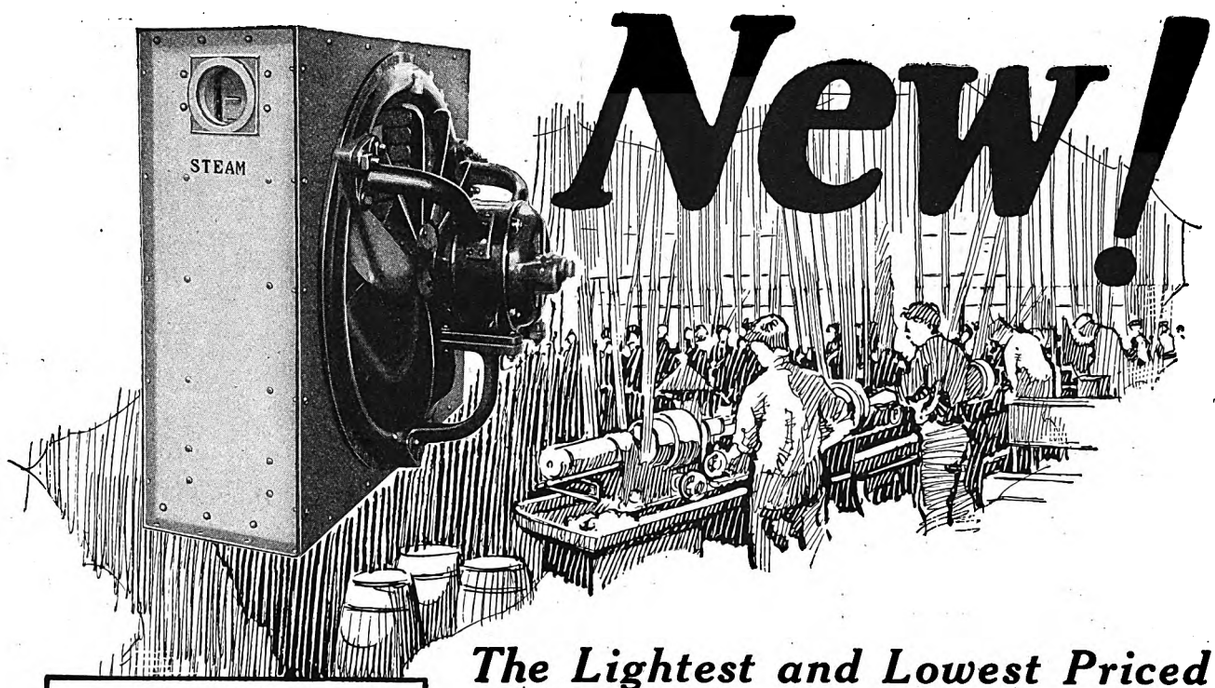
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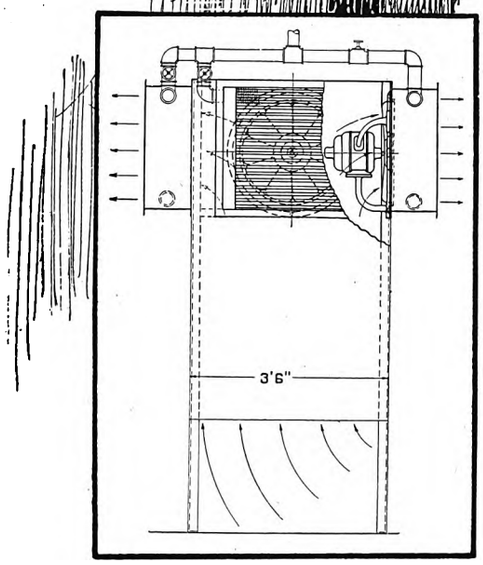
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(*Continued from page* 104)

boxes using knife switches in a steel box. Each switch should be numbered and a key or chart should be fastened inside the cover so that anyone can see what section of the room each switch controls. If only a few large groups are controlled from the switchbox it is well to have push button control on the columns.

The maintenance cost of fuses on properly designed lighting circuits should not be large, because the circuits should have ample capacity and should be correctly fused. On this service the one-time fuse will usually be lower in cost. Renewable fuses are often standardized all through the plant and in this case they should also be used on the lighting circuits. All fuses should bear the underwriters' approval.

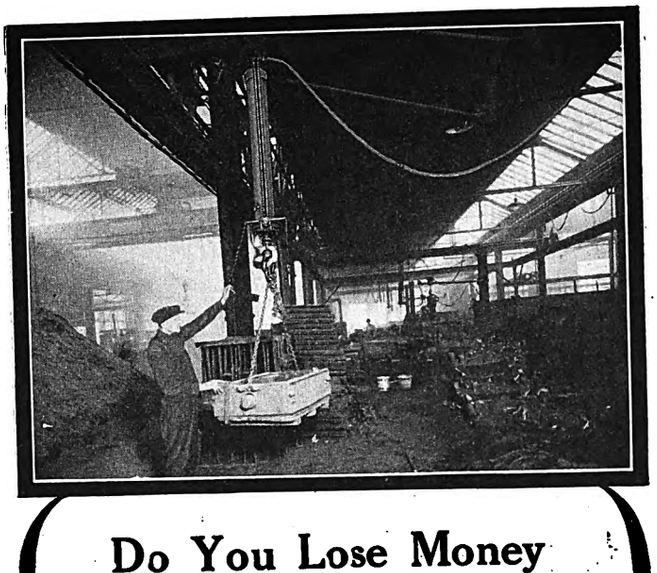
In many plants there are places where the lighting wires are not in conduit and this should be done whenever possible, especially when necessary changes are being made. The quality of the covering on wire has an important bearing on the length of time it will last as it has a tendency to dry up and get brittle and crack. The protective braid helps to keep the insulation intact as the wire is being pulled into the conduit. In order to install more or larger lamps it is necessary to reinforce the wiring either by putting in additional wire or by putting in larger wires. If the conduit is large enough, it is possible to replace the present wires with larger ones or to reinforce them by pulling in additional wire. This is why it is always advisable to put in conduit a trifle larger than necessary to take care of possible future additions.

Conduit fittings must be used when square corners are necessary on conduit work such as following around beams. However, when bends are possible they should be used as they save the expense of fittings and also allow pulling in the wire in longer lengths. Junction boxes and pull boxes should be of ample size to make it easy to pull the wire through and allow room for the spliced ends.

Stairways should be well lighted for safety's sake. The usual intensities provided in the codes are very low and two to five foot-candles are recommended. Stairways should preferably be on an independent circuit carried from the point where the main service enters the building, so that if anything happens to the lighting in one room, the stair lighting will be all right. The sills at elevators are another important place that should be well lighted in order to insure safety to the men using trucks.

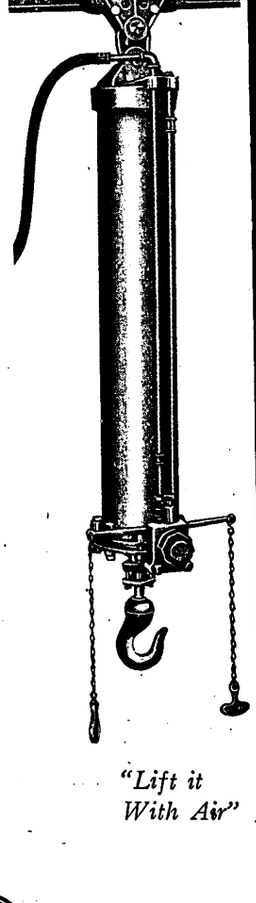
It has been proved that high intensity illumination has increased production in the plant and the same increase may be expected in the office. The eye is soon fatigued when a typist is working on a typewriter if it is not properly lighted because the shifting shadows strain the eye. For general clerical work an intensity of ten to fifteen foot-candles is now being used by many progressive firms although most of the standards now in use are from five to ten foot-candles. Semi-indirect lighting is more efficient than totally indirect and is therefore used more often. Direct lighting is the most efficient means of getting the maximum illumination for the same amount of power. However, bowl enameled lamps should always be used in open bottom reflectors to eliminate glare, and if possible reflectors should be used that are translucent in order to avoid a dark ceiling which

(*Continued on page* 110)



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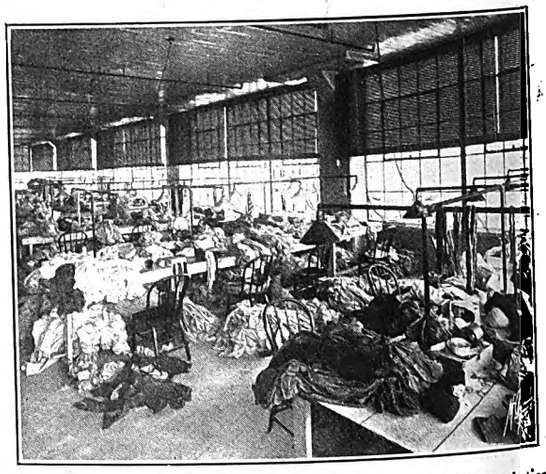
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makes the room appear gloomy. Totally enclosed glass units that reflect most of the light downward without glare are very efficient and produce a uniform intensity and a pleasing appearance.

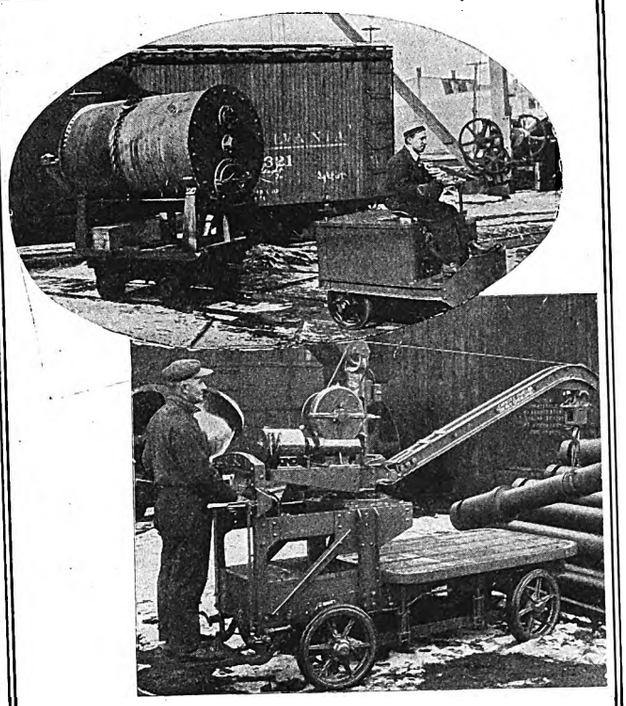
Drafting rooms require a high intensity of well diffused illumination and a very even distribution in order to avoid shadows when working close to a triangle or T-square. The lighting should be arranged so that the direction of the light at tables near the windows is the same as daylight. This usually requires that a row of lights be hung about two feet from the windows. Sometimes a medium general illumination is supplemented by a local lamp for each drawing board. These local lamps are usually of the movable bracket type so that the light may be directed where it is needed. There is more liability of glaring reflections with local lamps as most people are continually shifting their lights around.

The wiring for a calling system for finding executives out in the plant is usually very simple. Various systems of bells and lights are used with the control box at the telephone switchboard. Once properly installed very little maintenance is necessary except an occasional adjustment on a bell.

Some sort of inspection is necessary if the efficiency of the lighting installation is to be kept up. The periodic check up with a foot-candle meter to make sure that the system is all right should also include a check with an ammeter and voltmeter to see that power is not being wasted. In many cases nearly half of the light which is paid for is wasted because no attention is paid to maintenance requirements. If the value of the light wasted was the only point to be considered the matter would not be serious, but to get a correct figure on the value of this light it is necessary to take into account the decrease in production due to the smaller amount of light. When this is figured out the cost of the wasted light will be found to be so high that the waste will not be allowed to go on very long.



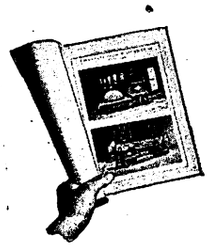
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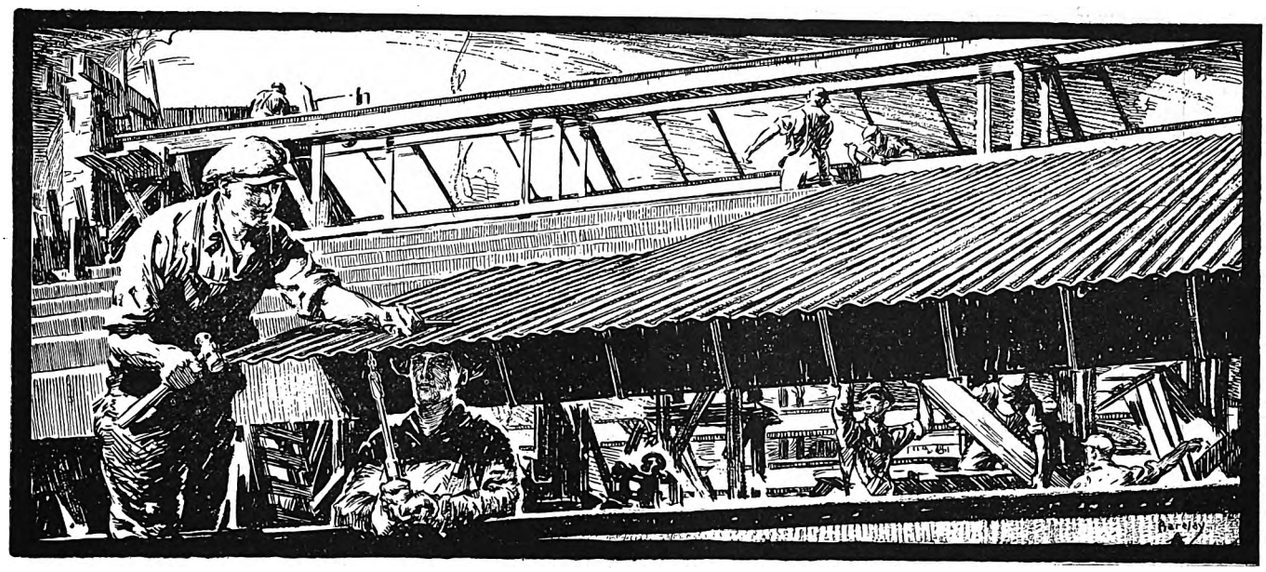
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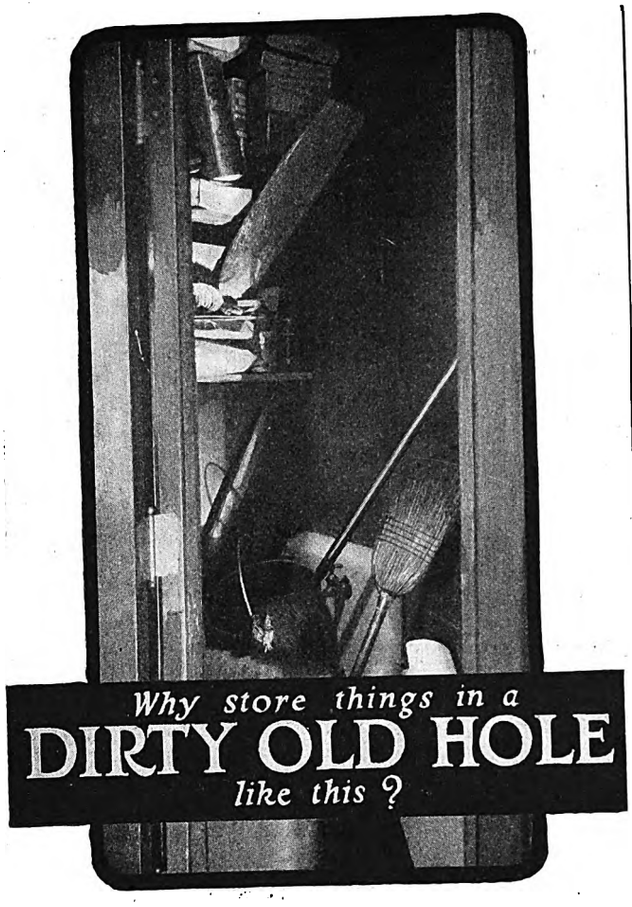
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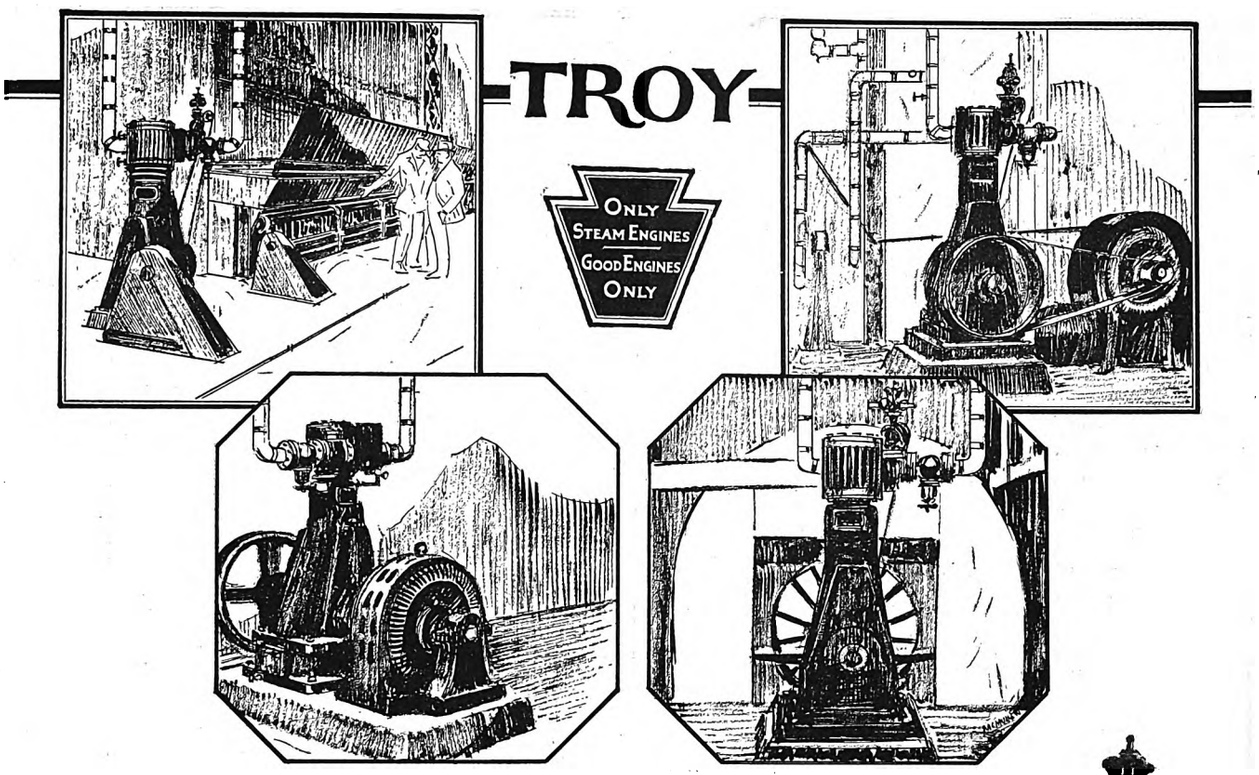
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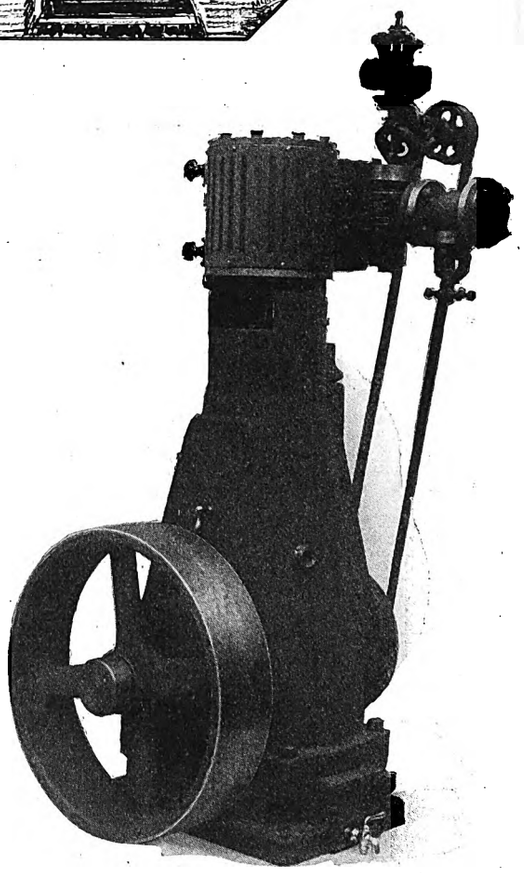
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Where Greater Power in Smaller Space is Needed



To-day, greater care in the choice of power units is imperative. The introduction of higher steam pressures and temperatures make necessary sturdier equipment. But, that does not necessarily mean larger in size.

The New Troy while of extra heavy construction and greater overload capacity is still the same small engine, but with greater power. It is built more compact, but still retains all the Troy Features; which have made the name Troy, stand for the last word in Engine Design.

Troy Engines are universally used for driving stokers, fans, blowers, pumps, compressors, as auxiliaries to the larger prime movers, or direct connected to electric generators.

All Troy Engines are equipped with the Troy system of Automatic Lubrication, which supplies each bearing with an abundance of oil. Also, the Balanced Valve which relieves the cylinder of any condensation—assuring absolute safety.

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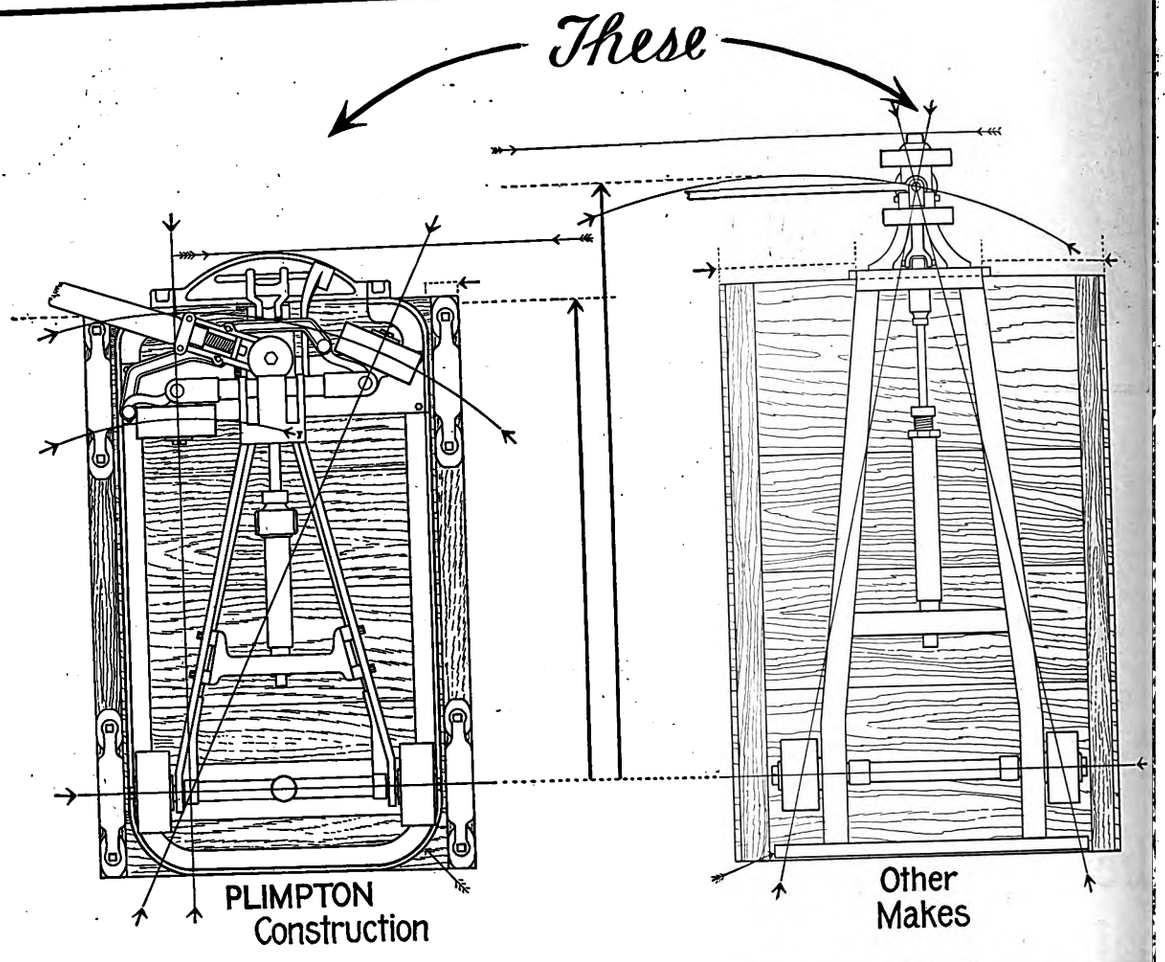
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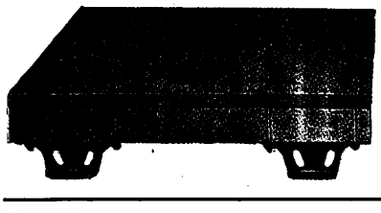
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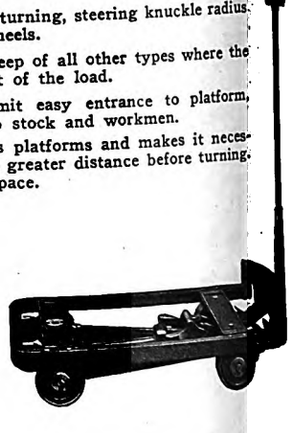


Tell You Why PLIMPTON TRUCKS for 10 years Sold on Merit Alone

1. Plimpton Trucks have the four square wheel and platform leg alignment and utilize the full uniform width of platform.
2. The triangular three-point suspension truck cannot provide either load stability or sufficient platform support in front.
3. The Plimpton because of its under-hung front wheels is the shortest lift truck built. It can be used on standard floor scales and in the smallest elevators.
4. All trucks having front wheels which project beyond the load require greater turning radius. The wheels do not align with the platform legs and loads must be lifted higher to avoid legs striking sills.
5. Narrow truck width in front causes platforms to bend up in the center when lifted. This loosens and spills the loads, and even a low load is unsafe.
6. Compare the above wide expanse of unsupported platform surface with the wide front end of the Plimpton which cups the platforms.
7. Note the shorter, right angle turning, steering knuckle radius of the two Plimpton front wheels.
8. And the necessary longer sweep of all other types where the front wheels are out in front of the load.
9. Large rounded corners permit easy entrance to platform, save rebacking and injury to stock and workmen.
10. A sharp rear corner destroys platforms and makes it necessary to withdraw the truck a greater distance before turning. This requires greater aisle space.
11. The equal underneath spacing of the axles on Plimpton Trucks permit exact wheel alignment with platform legs, which is retained by the vertical lift.



Our Engineering Service is available to every Executive without cost, for all handling problems, whether for lift trucks or otherwise.



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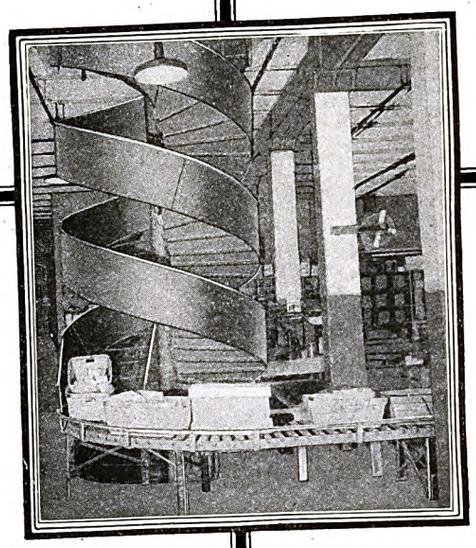
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In this Issue

Industry's Debt to Materials Handling

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Erner and Hopkins Company, Columbus, Ohio, invested $2330 in a Standard Spiral Chute.

Previous to this time they lowered and elevated their merchandise with two electric elevators.

In one year they found that their electric bill had dropped from $1200 to $180—a saving of $1020.

You may discount the increased speed, the saving of time, and the saving of labor—and still have an investment too great to be wisely overlooked.

May we send you our Booklet S-6 which tells more fully how Standard Conveyors save for industries?



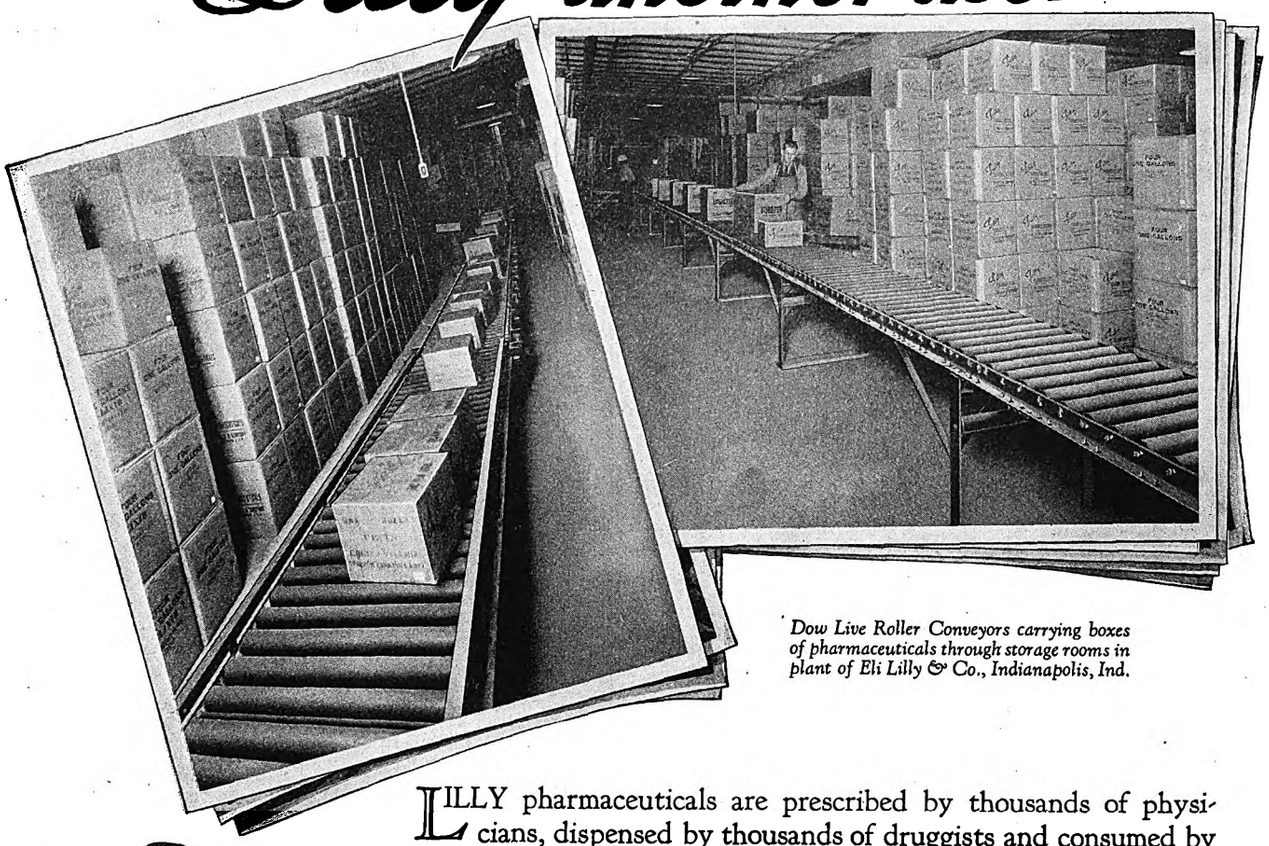
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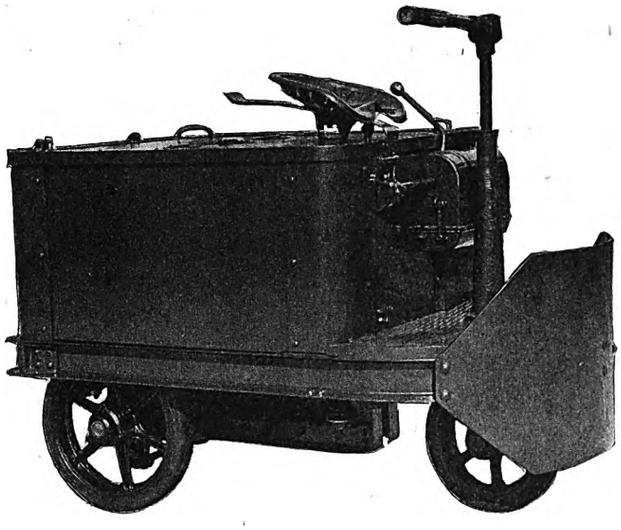
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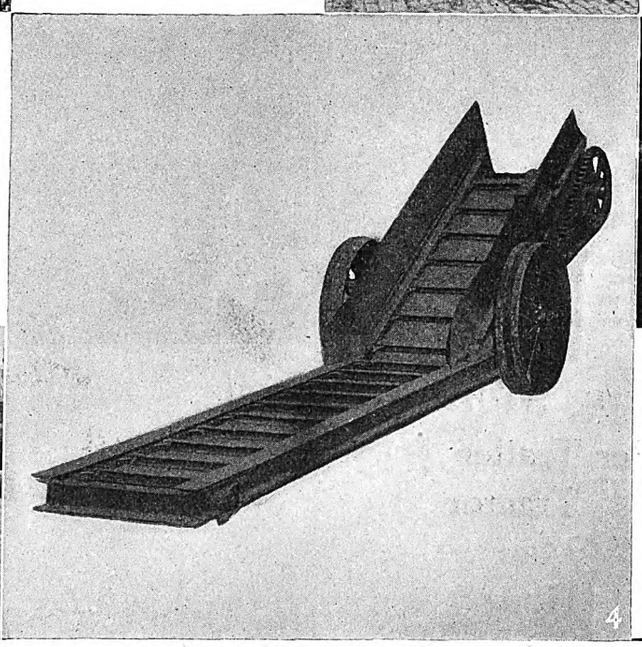


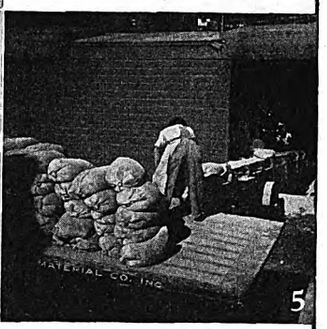
1—*Showing the Barber-Greene Coal Feeder discharging to conveyors. It unloaded a 50-ton car in 55 minutes to inside storage.*



2—*Where two Barber-Greene Conveyors enable two men to handle 4000 tons of coal a month the year 'round.*

3—*Two Barber-Greene Conveyors and one man have replaced six men in handling sand, coal and slag at the Spaulding Coal Co., of Elyria, Ohio. One of these, the U-Type, is shown here. Its base price is $350.*





4—*The Barber-Greene Coal Feeder. Its horizontal extension rests on the rails so that no pit is required. It is enabling many plants to do away with expensive shovel gangs.*

5—*Showing a Barber-Greene Conveyor unloading a barge of cement for a large materials company.*



Storing From Hopper-Bottom Cars Without Shovelers

A certain company in Detroit found that it was costing them $25 to $30 a car to unload their coal by hand—or a yearly total of $3900.

Yet as they used only three cars a week, the tonnage was too small to warrant the expense of elaborate equipment, such as track pits, elevators, etc.

Various methods were considered. Conveyors alone, while they would store the coal well back from the track, would not eliminate the hand labor required for unloading.

A single Barber-Greene Coal Feeder, together with two Barber-Greene Conveyors, completely met this problem—at a saving of $17.31 on every car, or $2700 a year. As the equipment cost $2800, it practically paid for itself in the first year.

The feeder, working in a permanent track hopper, eliminates the need for a pit, and takes the place of five or six shovelers. It catches the coal as it flows from the car, carries it to the first conveyor, which relays it to the second. The second carries it to storage.

In this manner an entire car was unloaded in 50 minutes, with only one man operating. A second man was needed only when the car was moved from one pocket to another.

Thus the Barber-Greene Coal Feeder, used in conjunction with other equipment, acts as the "missing link" which will enable any plant to do away with expensive shovel gangs.

Send for Catalog E on the Coal Feeder. It may hold the answer to your unsolved coal-handling problem.

BARBER-GREENE COMPANY, 500 West Park Avenue, Aurora, Ill.

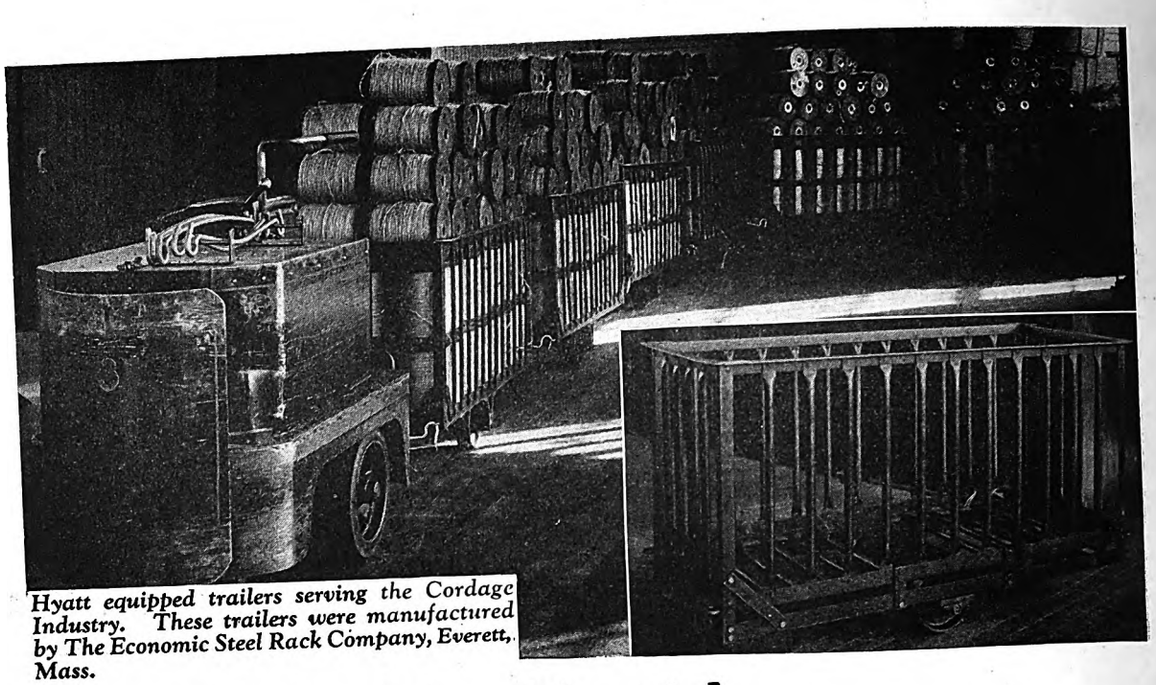
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" Tractor
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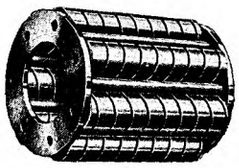
At a Lower Cost

EASY running Hyatt equipped trailers made by the Economic Steel Rack Company start and move with so much less effort than is required for plain bearing equipment that a tractor or truckman can handle more trailers with less expenditure of power or energy.

This results in rapid and economical handling of material and boosts plant productivity at the lowest cost per ton.

Maintenance economies result from the elimination of bearing trouble and the oil conserving feature of Hyatt bearings. Oiling three or four times a year is the only attention required of Hyatt equipped trailers.

For lowest costs in material handling specify equipment with Hyatt bearings.



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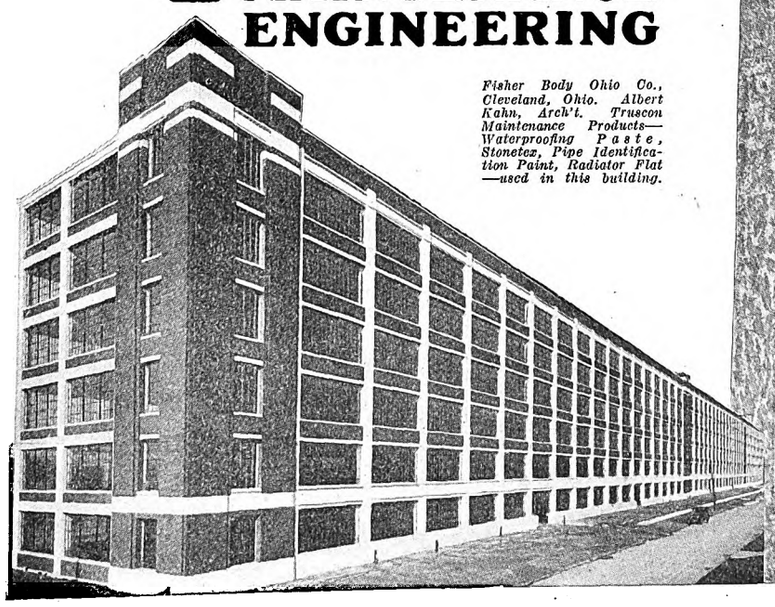
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Our Bulletin 1994 covers these tests in detail. We will be glad to send a copy to those interested in getting better results from their industrial trucks and tractors.



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The paragraph quoted above is the brief introduction to our booklet containing a letter from each of the twenty-four concerns whose average yearly profit on JACKLIFTS is over 600%.

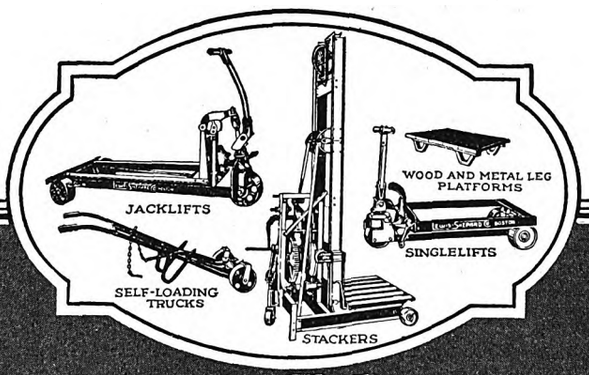
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Lewis-Shepard Co.

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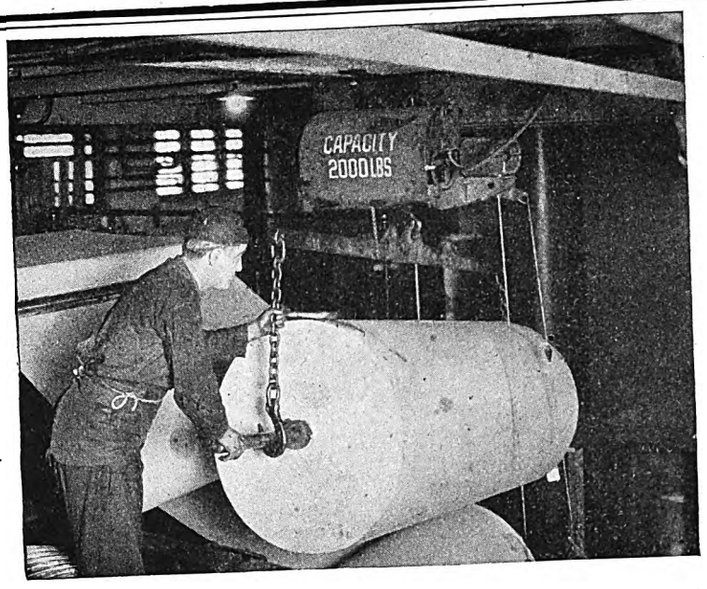
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"Lo-Hed" Hoist (2,000 lb. capacity) made by American Engineering Company, Philadelphia, Pa., in operation at the Hudson Printing Company, Hoboken, N. J.

This hoist requires very little head-room, as the picture indicates. Hyatt roller bearings are used throughout the hoist mechanism and in the trolley wheels, insuring satisfactory operation.

The Result of 20 Years' Experience

AS a result of twenty years' experience in planning and constructing hoists, the engineers who designed the "Lo-Hed" monorail hoist, "the electric hoist that operates in the minimum headroom", used Hyatt roller bearings throughout.

The American Engineering Company mentions among the features of its "Lo-Hed" hoists, that are of particular value, the following:

"Lo-Hed" Advantages

1. "Positive automatic lubrication and minimum wear, because all gears and main bearings operate in an oil bath."
2. "Mechanical efficiency of over 80%."
3. "Only the best materials and finest workmanship are used in its construction."
4. "Frictional losses are reduced to a minimum by the use of Hyatt 'High-Duty' bearings throughout."

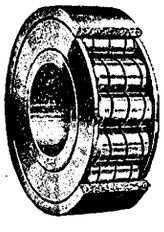
Note—

Hyatt roller construction makes them self lubricating and self cleansing. Some Hyatt bearings have been operating over 33 years without appreciable wear.

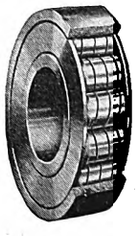
True rolling motion of Hyatt bearings reduces friction 50% to 75%.

Hyatt rollers are made of chrome-alloy steel, hardened and ground. Hyatt races are of high carbon steel in all cases

Actual tests under operating conditions show that substantial power savings result from the use of Hyatt roller bearings on trolleys, cranes and hoists.



You can obtain fully dependable and economical material handling machinery by specifying "Equipped with Hyatt roller bearings."

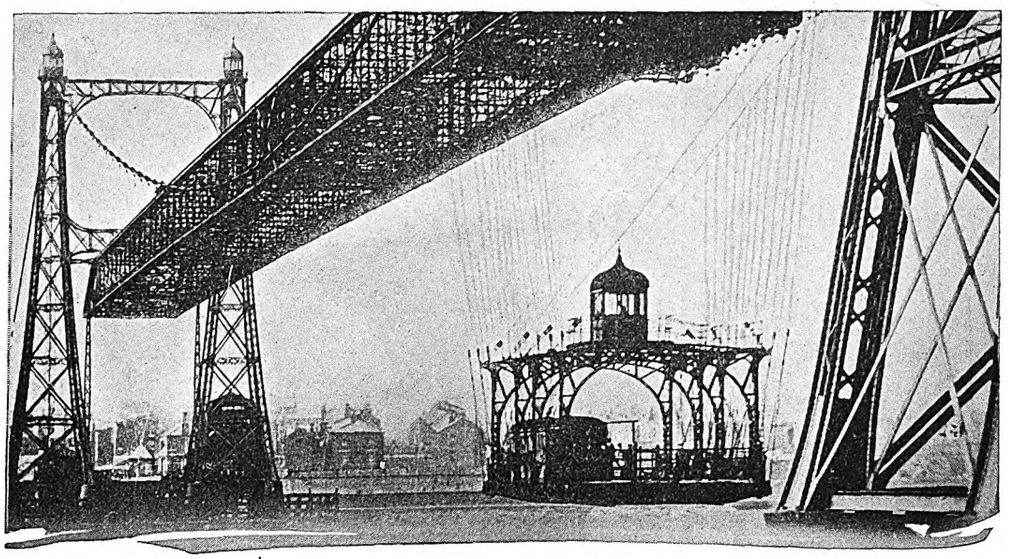


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Ball Bearing Aero-Ferry Makes 1000-Foot Trips Across Mersey River

SWINGING high above the water this aero-ferry of the Widnes Transporter Bridge, connecting the little manufacturing town of Widnes, Lancashire with Cheshire, England, makes 1000-foot trips across the Mersey River carrying passengers and vehicles. The aero-ferry is suspended by steel cables from a truck travelling on the lower part of the bridge. The towers are 200 feet high.

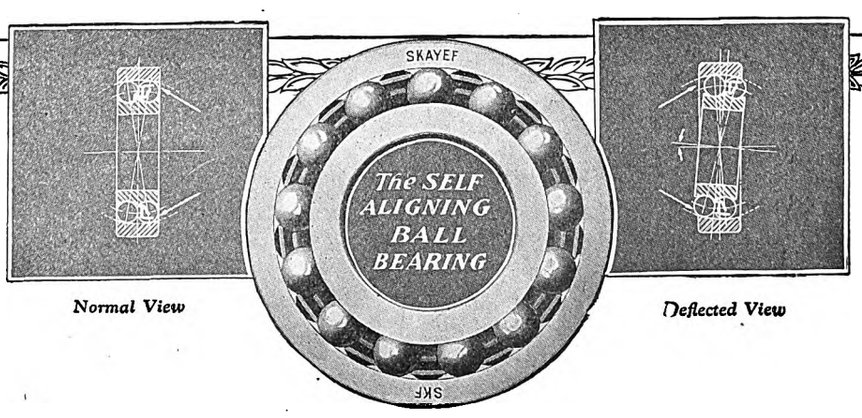
Skayef ball bearings on the wheels of the truck, which is 55 feet long and 24 feet wide, make possible the non-failing service of this novel ferry. The load is carried on polished steel balls which roll practically frictionless in hardened races of steel.

Although this is an unusual application of Skayef ball bearings, they will give the same degree of unfailing performance, reduce friction, save power and cut maintenance costs, when applied to automotive and industrial equipment.

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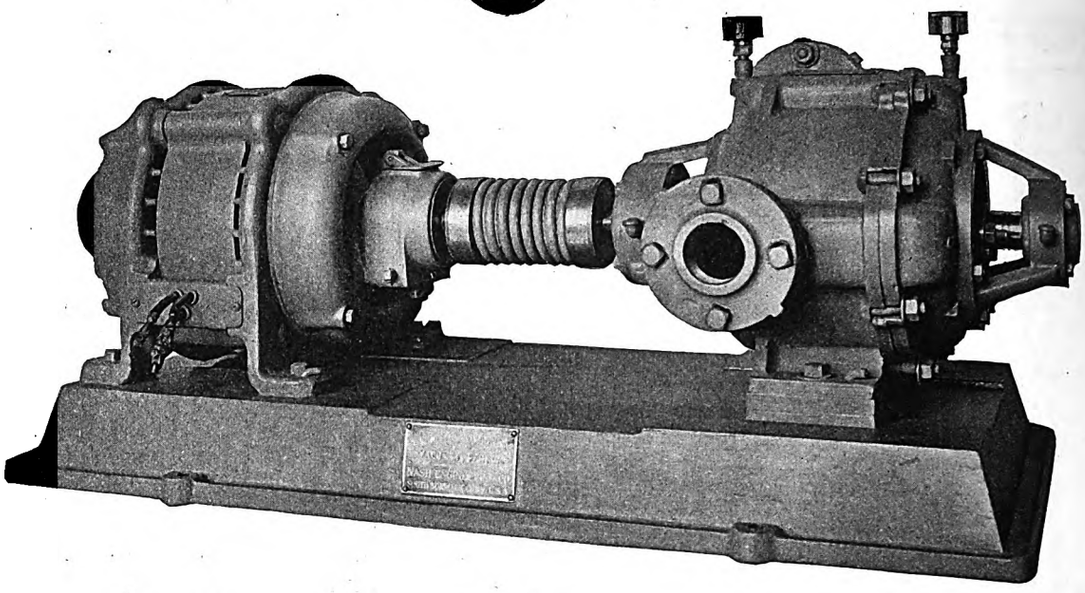


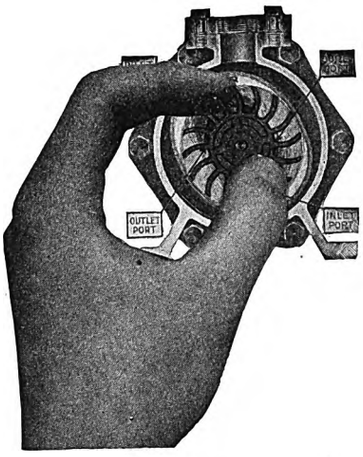
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Industry Illustrated

The Pictorial Presentation of Practical Management

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Editorial

What Does "Labor-Saving" Mean?

IT was less than a hundred years ago that the school board of Lancaster, Ohio, indignantly refused the use of their school house for a meeting to discuss whether railroads were practical; stating as the basis for their refusal, that "such things as railroads are impossibilities and rank infidelities."

It is little more than a hundred years since Dr. Cartwright's invention of the power-loom precipitated strikes and sabotage on the part of the hand weavers, who felt that this wonderful invention would destroy their means of livelihood.

Only sixty years ago, in England, a law was passed for the regulation of road locomotives—forerunners of the modern automobile—which required a speed of less than four miles an hour, and further required that a man with a red flag should precede the locomotive!

In truth, machinery has had a hard time of it in convincing mankind of its benevolent intentions. At every step of the way it has met with determined and deeply entrenched resistance: the resistance of prejudice, of ignorance, of superstition. And, slowly but surely, the mechanical ideal has conquered; until, today, even the non-technical man in the street begins to realize that in the wider use and fuller development of mechanical genius lies the immediate hope of a more desirable state of human existence.

There is one misconception, however, which remains to a greater or less degree: the conception that every new labor-saving machine put into operation means just so many men deprived of jobs; that a machine which "can do the work of thirty men" will, therefore, deprive those thirty of a means of livelihood.

A hundred years ago, when the factory system was new, the introduction of the power-loom did temporarily deprive men of jobs; but in a few years' time it had created vastly more and better paid jobs than had existed before. Today, with the multiplicity of jobs, skilled, semi-skilled, and unskilled, this same readjustment is a matter not of years but of days.

Picture the Ford plant at River Rouge, stripped of its labor-saving machinery. How many cars could it produce; how many people could afford to buy these cars at the necessarily higher price; how many men would the Ford Company have to employ, and what could it afford to pay them?

Labor-saving machinery *saves labor*. It does not dispense with laborers; it does not do away with men's means of livelihood. Labor-saving machinery provides a means of *saving*—and *storing* up—labor; making the work of men vastly more productive, and gradually lifting mankind from the necessity for back-breaking, soul-destroying drudgery.

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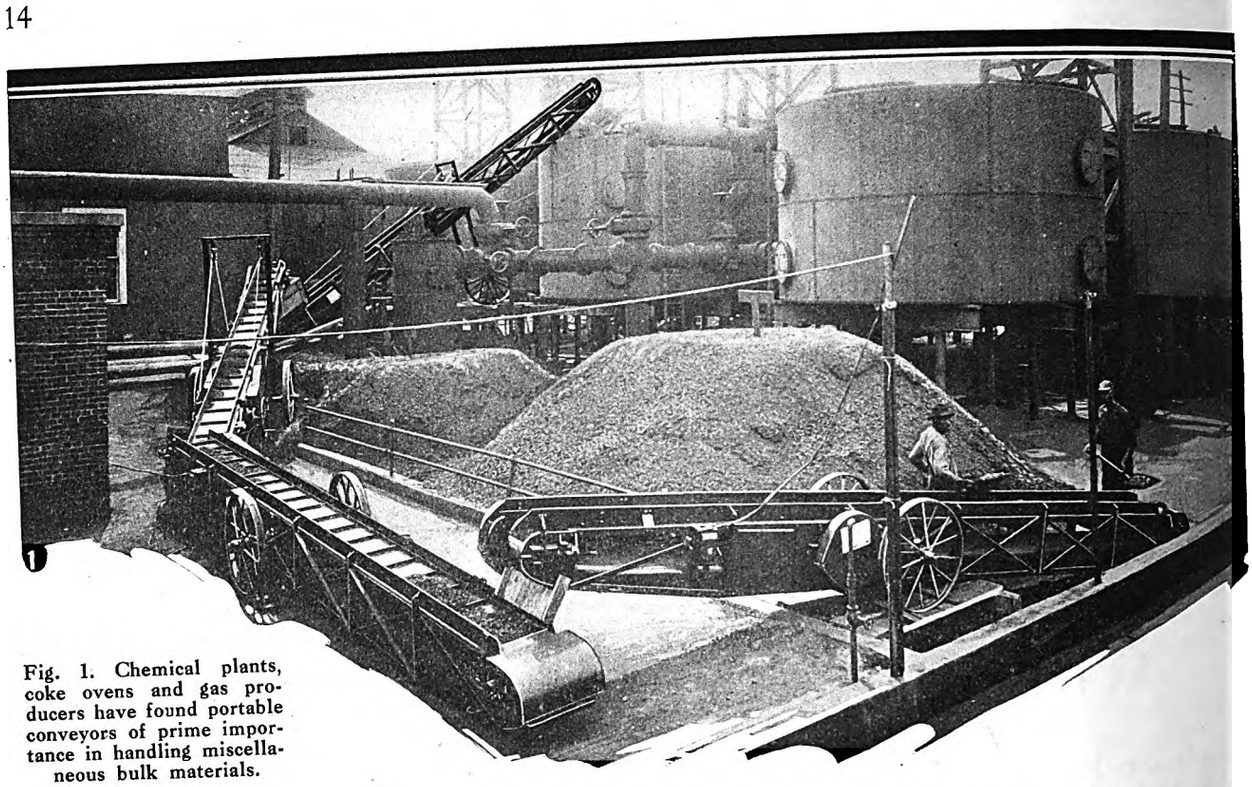


Fig. 1. Chemical plants, coke ovens and gas producers have found portable conveyors of prime importance in handling miscellaneous bulk materials.

Industry's Debt to Materials Handling

The Keystone of Modern Production Methods

By Matthew W. Potts

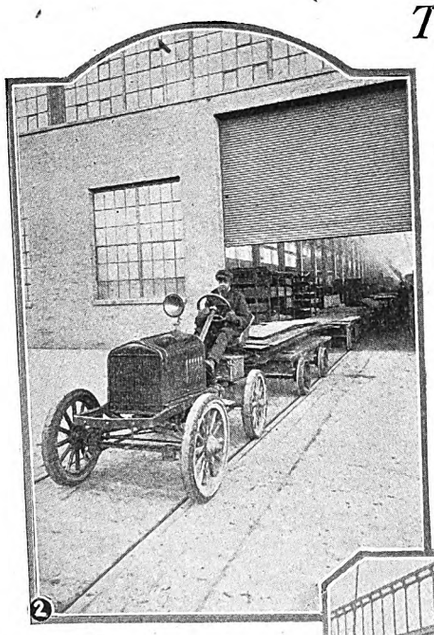


Fig. 2. The sheet metal industry, or industries where sheet metal is used in quantities, employ many forms of cranes, cars, stock racks, etc., in order to reduce their handling costs.

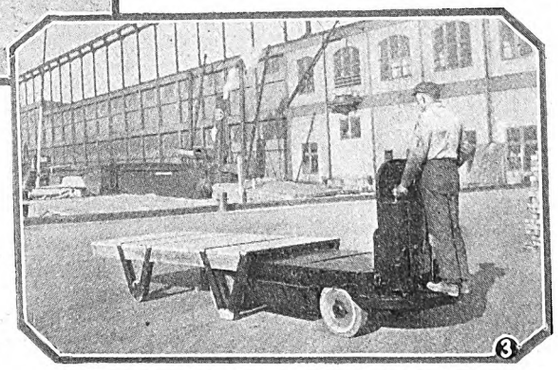


Fig. 3. Warehouses and docks have many handling operations where skids and lift trucks are economically employed.

TEN years ago, industry throughout the United States and Europe gave very little consideration to the conservation and proper application of labor, especially common or unskilled labor. In 1914, when Europe was called upon to take men from industry in order to seemingly settle the affairs of the world it became necessary to replace this man power by mechanical devices. For many years, conveyors had been in operation in various industries, but now a new stimulus brought out a number of new developments and many applications. About 1916, industries in America were called upon to produce war materials to aid in the conflict on the continent of Europe. Executives will remember how quickly the effect of reduced immigration and increased production was felt, particularly in a shortage of common labor. Up to this time, these executives had been more or less backward in applying mechanical methods to the transportation of materials within the plant, as cheap common labor had always been plentiful, but the new and urgent demands necessitated immediate installations. The experience gained between the years 1916 and 1920 in the application and use of materials handling equipment has shown that much human effort can be conserved and applied to other operations by employing mechanical devices to handle materials instead of handling them by hand.

Immigration has been at a mini-

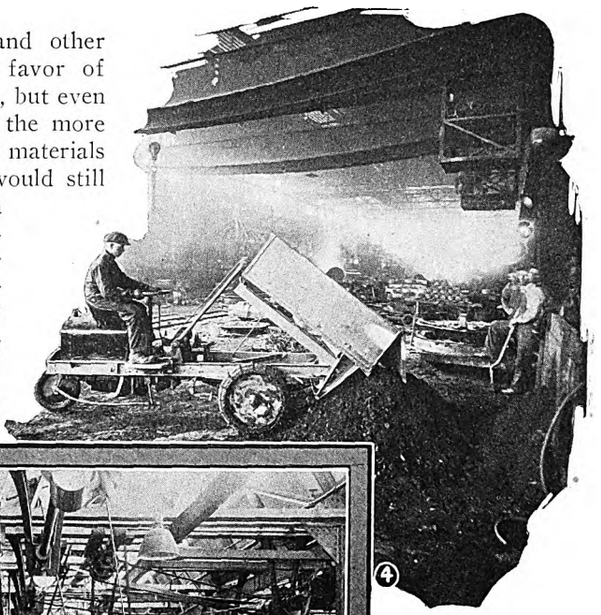
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mum since 1914 and now laws are being passed which will keep it at a minimum, thereby making it necessary for Industrial America to turn to its proper source of cheap labor, namely mechanical power, of which materials handling equipment is one of the biggest factors. The proper application of this factor is now being investigated by many executives, enginering societies and others, and the solution of a number of difficult problems is the result. In addition there is brought about lower production costs and the elimination of waste as well as a conservation of common labor.

Not so many years ago, each installation of materials handling equipment was more or less of an experiment, but today there is hardly an industry that has not installed one or more pieces of this equipment and the money savings effected by the installation has been added to industrial profits. It is the profits of industry that affect the economic life of the nation and therefore increased profits are greatly to be desired and any factor which tends in this direction should be investigated and given serious consideration.

Many executives and other organizations are in favor of increased immigration, but even if this were possible the more extensive use of materials handling equipment would still go on, for it has been found that this equipment has three major advantages, *it saves money, time and space,* money being saved by reduced labor costs. To illus-

Fig. 4. Foundries employ overhead traveling cranes, industrial cars operating on rails, gasoline driven dump body trucks and other devices for handling materials in the production of castings.



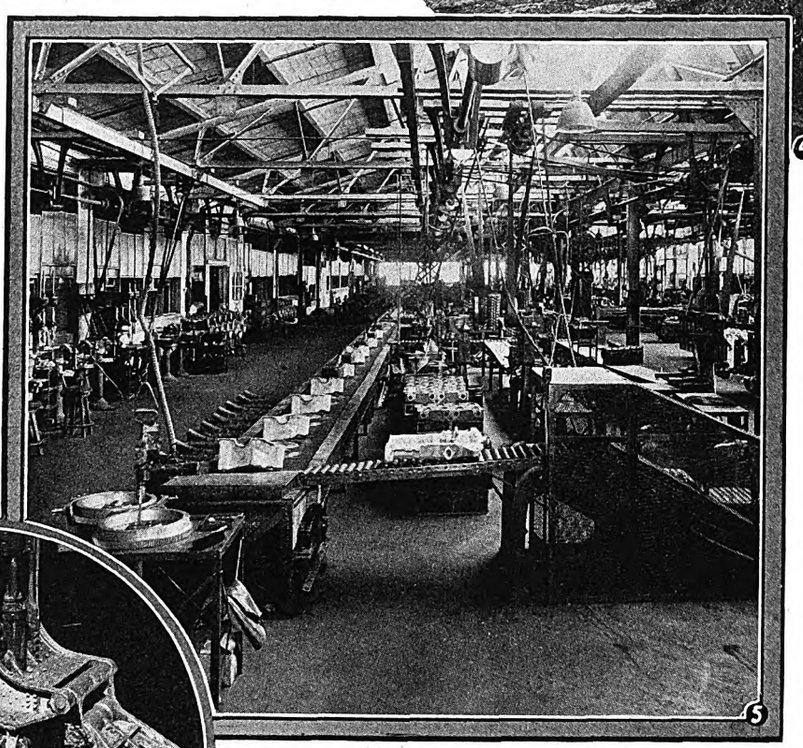


Fig. 5. The Automotive Industry and its success with quantity production has been largely due to the extensive use of all types of conveyors and elevators.

Fig. 6. Close-up view of the seven-ton scoop bucket shown in Fig. 20.

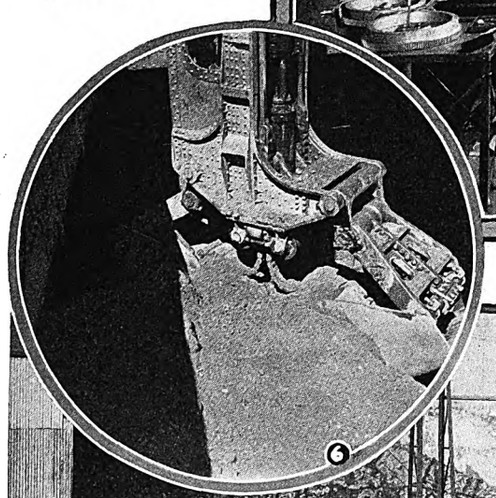
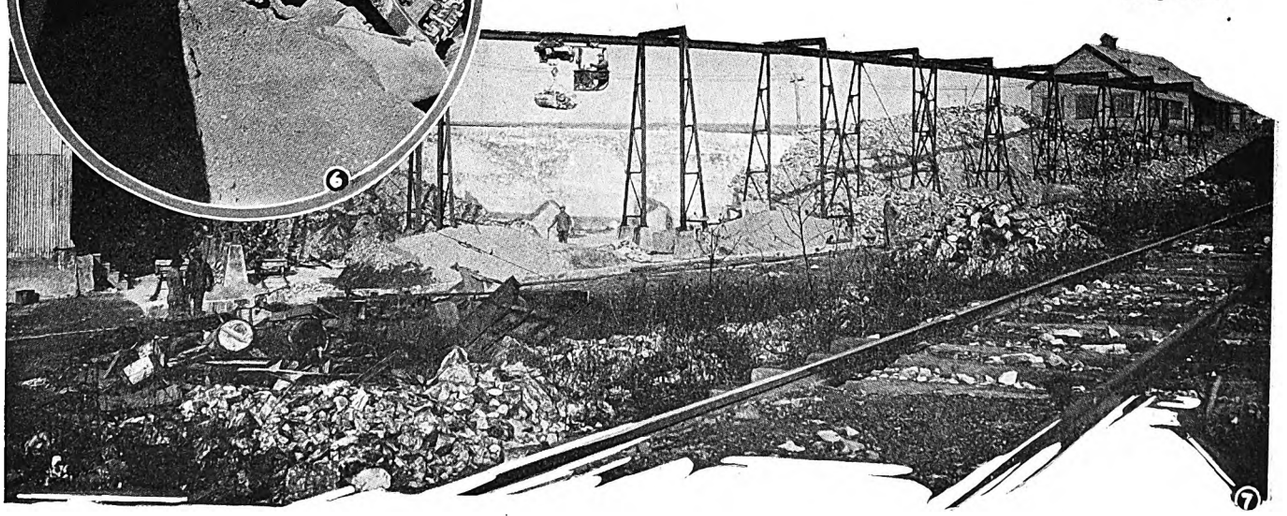


Fig. 7. In handling ore, limestone and similar materials, mono-rails equipped with various types of buckets have speeded up the work and reduced the handling costs.



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trate this point that regardless of the immigration question, materials handling methods will continue to be applied, we refer to Fig. 21, where American conveyors have been shipped from this country to compete with the cheapest labor in the world. If industry abroad is willing to buy our materials handling equipment to assist labor in a market where there is no need for conservation it behooves American industrial executives to investigate their handling problems and apply mechanical means of transportation wherever possible.

There is a tendency on the part of executives to feel that their industry is the one industry that cannot use mechanical equipment for handling materials and with this in mind the illustrations shown herewith have been selected at random in order to point out that all industries can use one or more types of materials handling equipment on many operations. In these pictures we see equipment operating in chemical and gas plants, sheet metal shops, on docks and piers, in foundries, machine shops, raw material storage yards, metal stamp-

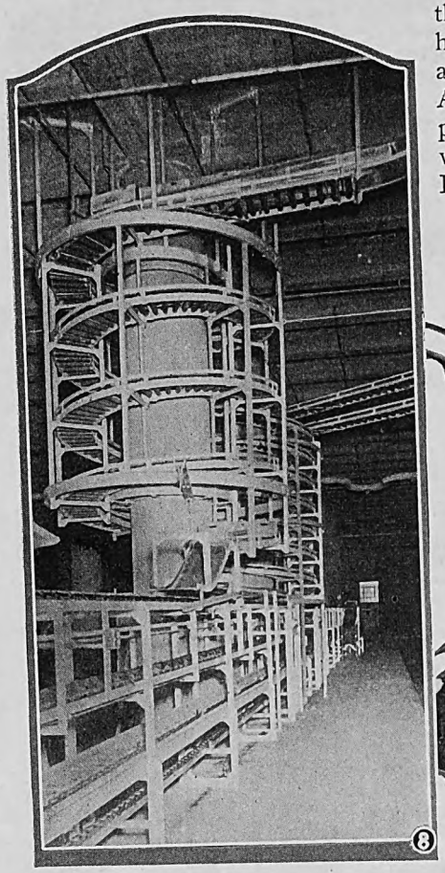


Fig. 8. Gravity conveyors and gravity roller spiral chutes, also mechanical conveyors, play an important part in the loading of cars at this large beverage bottling plant.



Fig. 9. In the stamping of metal parts it is important to carry the finished products away from the machines as quickly as possible.

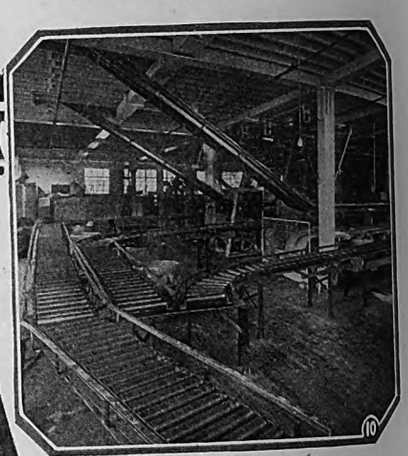


Fig. 10. The handling of soap, in many forms, is now done by various mechanical conveyors. This shows a few employed in one large soap factory.

Fig. 12. In warehouses, machine shops and production buildings, the crane bay is an important factor. Note the overhanging unloading platforms on all floors.



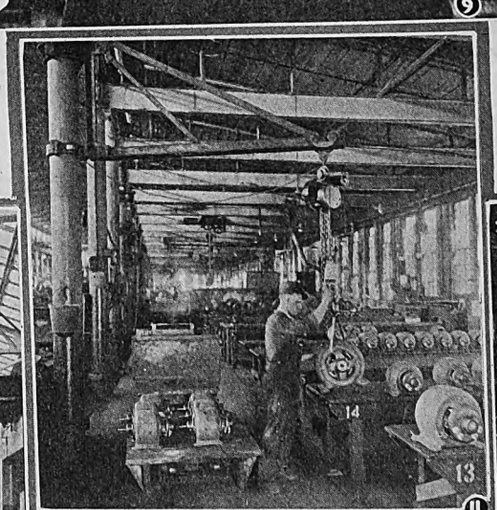
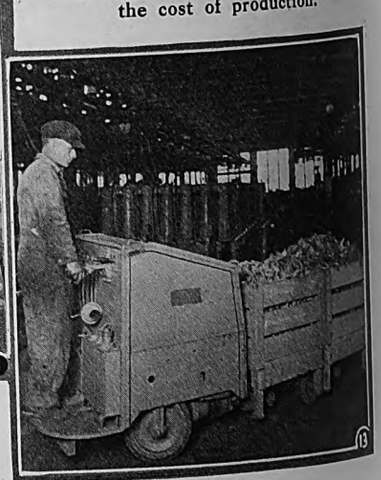


Fig. 11. The jib pillar crane, the electric driven chain hoist and the electric lift truck are here shown assisting in the production of electric motors.

Fig. 13. In machine shops and foundries, industrial lift trucks, operated by gasoline and electricity, have greatly reduced the cost of production.



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Barring the Gates

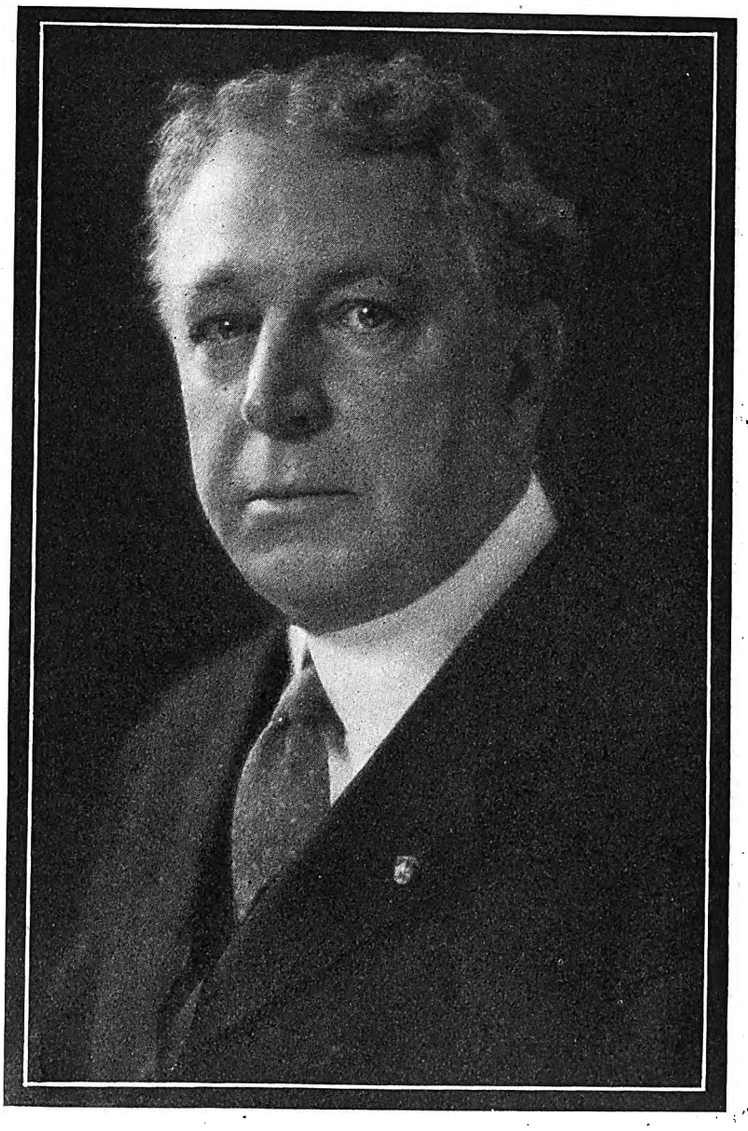
Introducing the Father of Immigration Restriction, and Commenting on Its Effects

THAT our new understanding of the immigration problem has borne fruit in the restrictions which will go into effect on the 30th of June, is due in large measure to the work of Hon. Albert Johnson, whose portrait appears on this page.

There has been much propaganda, of varying degrees of disinterestedness, for and against restrictive measures. Perhaps it is not amiss to quote here from a recent speech of the man who, by reason of his work as chairman of the House Committee on Immigration and Naturalization, is qualified to appraise the subject justly. Said Mr. Johnson:

"Our new immigration law is written for all who are now within the United States, for all who come under the protection of our great Constitution, which begins with the magnificent words of the preamble, 'We the people of the United States'—people, not citizens. We are all the children of immigrants, and our new immigration bill as written makes it clear that it makes no difference whether our ancestors came on the *Mayflower* or whether they missed the first boat.

"Now that real restrictive immigration legislation is assured, our next step is the development of real Americanization. It is our duty to reach out to every last person in the United States, of whatever race, to take him by the hand and let him know by word and deed that we are for him and that he must be for us."



Hon. Albert Johnson, chairman of the House Committee on Immigration and Naturalization, may be called the Father of Immigration Restriction. Through his efforts Congress passed the 3 per cent. quota law of May 19, 1921. This law goes out of effect on the 30th of June of this year, and is replaced by an even more severe restriction.

From the standpoint of the industrial executive, the subject divides itself into two heads. The first is the effect of immigration restriction on labor. The second is the effect on the use of labor-saving machinery.

The subject of labor has always occupied a place of first importance in the minds of American industrial executives. American labor has never been cheap labor. Cheap labor we have had, in certain industries and localities, but it has been European cheap labor and not American—the exception and not the rule, a temporary and local condition, not permanent, or general, or secure.

Because our labor has not been cheap, we have had to give a great deal of thought to labor-saving *machinery*—the substitution of mechanical power to make the production of high priced American workmen equivalent in value to that of the several European workmen whose daily labor can be purchased by the American workman's daily pay. Thus America has become, through the economic pressure applied by high wages, the world recognized home of improved machinery and power production.

From the standpoint of labor supply, and with regard to economic rather than political effects, the reduction from 3 to 2 per cent. and the change from the 1910 to the 1890 base combine to cause a net annual decrease of approximately 150,000 wage-earning immigrants. At an average daily wage of $3.50 (which is admittedly low) this labor amounts in money to the equivalent of more than half a million dollars per day, or close to one hundred and fifty million dollars per year. Assuming

(*Continued on page* 100)

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Systemizing Motor Production at Schenectady

By John H. Van Deventer

THE Induction Motor Department of the General Electric Company is one of the decentralized sections of the Schenectady Works, having its own engineering, drafting, production, cost, order and stock and factory organizations under the direction of a superintendent, all located in one manufacturing group. These various divisions of work are each controlled by a staff officer of the plant, but their efforts are coördinated through an engineer-manager in charge of the department. By this arrangement, all those directly responsible for the quality of the apparatus, its cost, shipping promises and capital lockup are brought into a controllable manufacturing unit.

Only the larger sizes of induction motors are made at Schenectady. These range in capacity, however, from around 10 horsepower to 22,650 horsepower; in size, from 18″ to 28′ in diameter, and, in weight, from 400 lbs. to 400 tons.

On the one hand, the problems of manufacture involve quantity production of standardized parts and, on the other, machining and assembling large, heavy parts. In capacities over 250 horsepower, all motors are made to order, while, below this, certain ratings can be carried in stock, the proportion of stock to special motors varying from about four-to-one in the smaller sizes up to one-to-four at 250 horsepower.

Between 10 and 250 horsepower, there are thirteen standard horsepower ratings. These are made for approximately eight different poles or speeds, both horizontal



Fig. 1. Forming stator coils. The wire is first wound by boys into a flat coil of the required number of turns, the ends cut to length, and wires tied by hand with cord to hold the coil in shape for moulding.

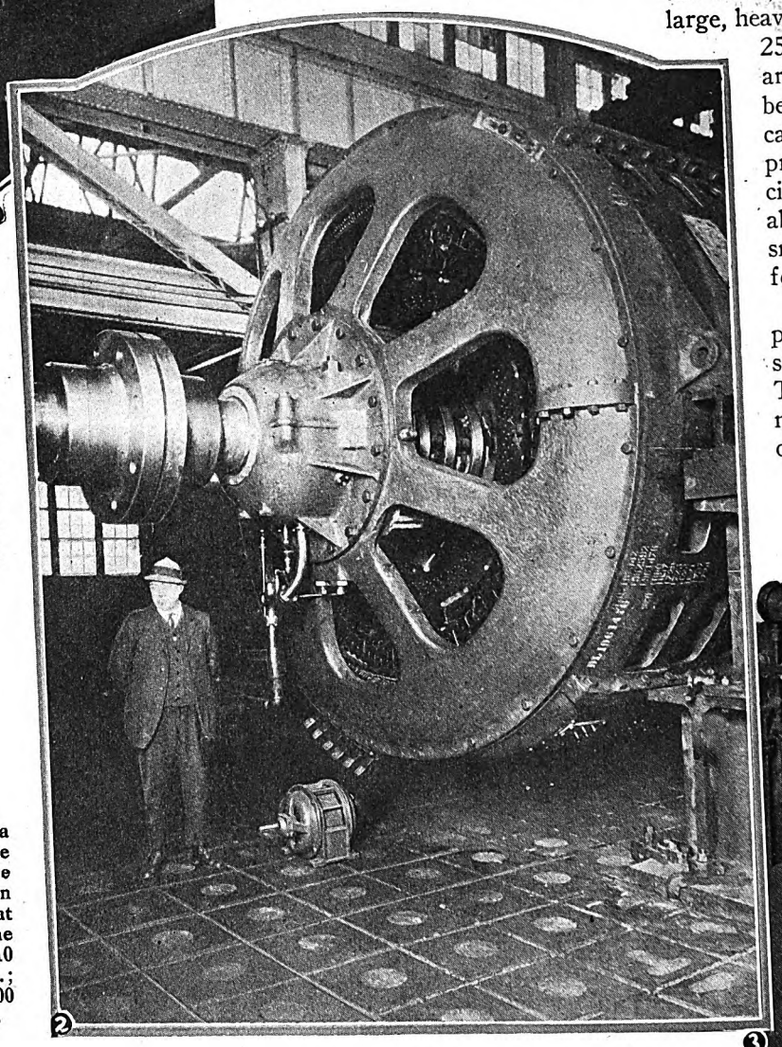


Fig. 2. Here is a comparison of the smallest and the largest induction motors made at Schenectady. The range is from 10 hp. to 22,650 hp.; weighing from 400 lbs. to 400 tons.

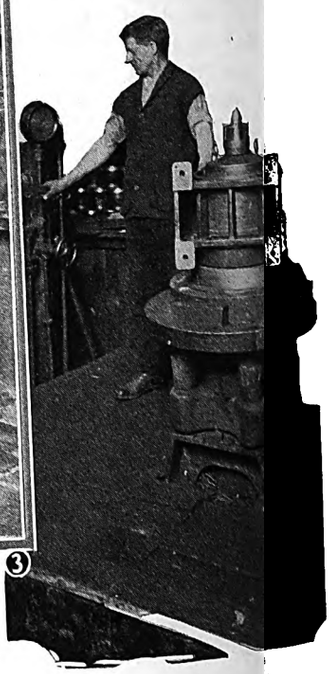
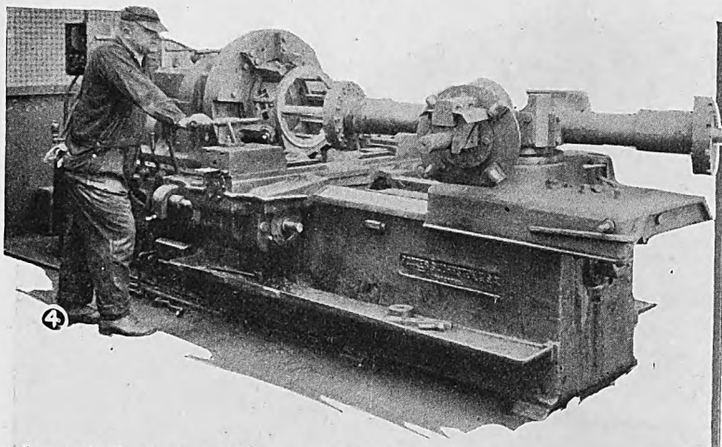


Fig. 3. Pressing and expanding stator punchings. The segments are made from a special grade of thin steel.

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and vertical, in two forms—squirrel cage and collector ring—for circuits of 60, 50, 40 or 25 cycles and 2200, 550, 440, 220 or 110 volts, and both three phase and two phase. The total number of varieties of ratings, therefore, equals the product of these different combinations, thus:

H. P. Ratings		Poles		Horizontal or Vertical		Form		Cycles		Volts		Phases	
13	x	8	x	2	x	2	x	4	x	5	x	2	=16,640

Such a list of ratings would include only those of standard construction, and it would be enlarged by including the special lines of motors made for special service, such as elevator, crane, coal mine, steel mill, attrition mill, textile mill, etc., so that the number of varieties of ratings is almost unlimited.

Only about 600 of these ratings are sold in sufficient quantities or at a rate even enough to be made for stock in advance of

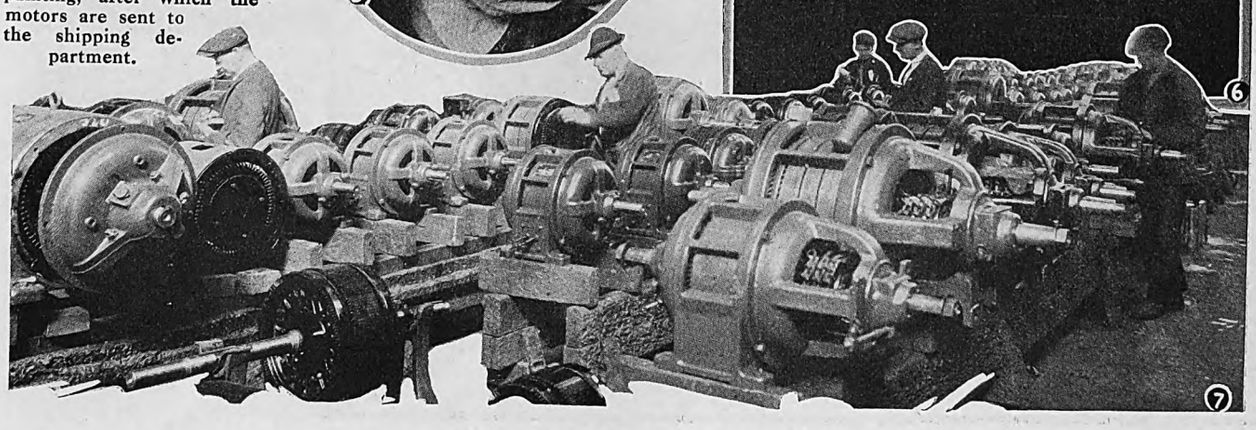
Fig. 4. The machining of stator spiders is so arranged as to coördinate the functions of the completed piece; the feet bottoms being first milled to provide a mounting surface for the boring mill.

Fig. 6. At the right—girls are employed in the winding of flat wire coils.

Fig. 5. Girls apply the insulation to stator coils, in the form of varnished cambric cloth wrappings, and linen tape, later filled with varnish.



Fig. 7. These men (below) are giving the careful final inspection preliminary to painting, after which the motors are sent to the shipping department.



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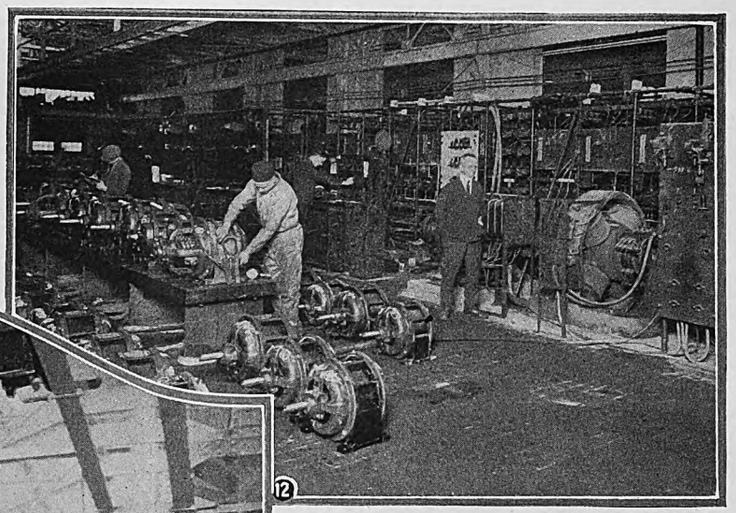


Fig. 12. The electrical tests of finished motors require elaborate apparatus and skilled men.

portant, to standardize manufacture.

From a manufacturing standpoint, the problem is to make use of special machine tools, jigs and fixtures only in so far as their use tends to reduce the cost of manufacture and no further. In other words, it is important to make the parts on standard machine tool equipment unless the quantity justifies special equipment.

One of the most interesting features, however, is the regulation of production schedules and the control of stock and ordering. The production of motors is based, not on the individual manufacture and stocking of semi-finished parts, but upon a scheme of quantity production of complete standard machines scheduled and regulated over a definite period of time. This production scheme might more properly be

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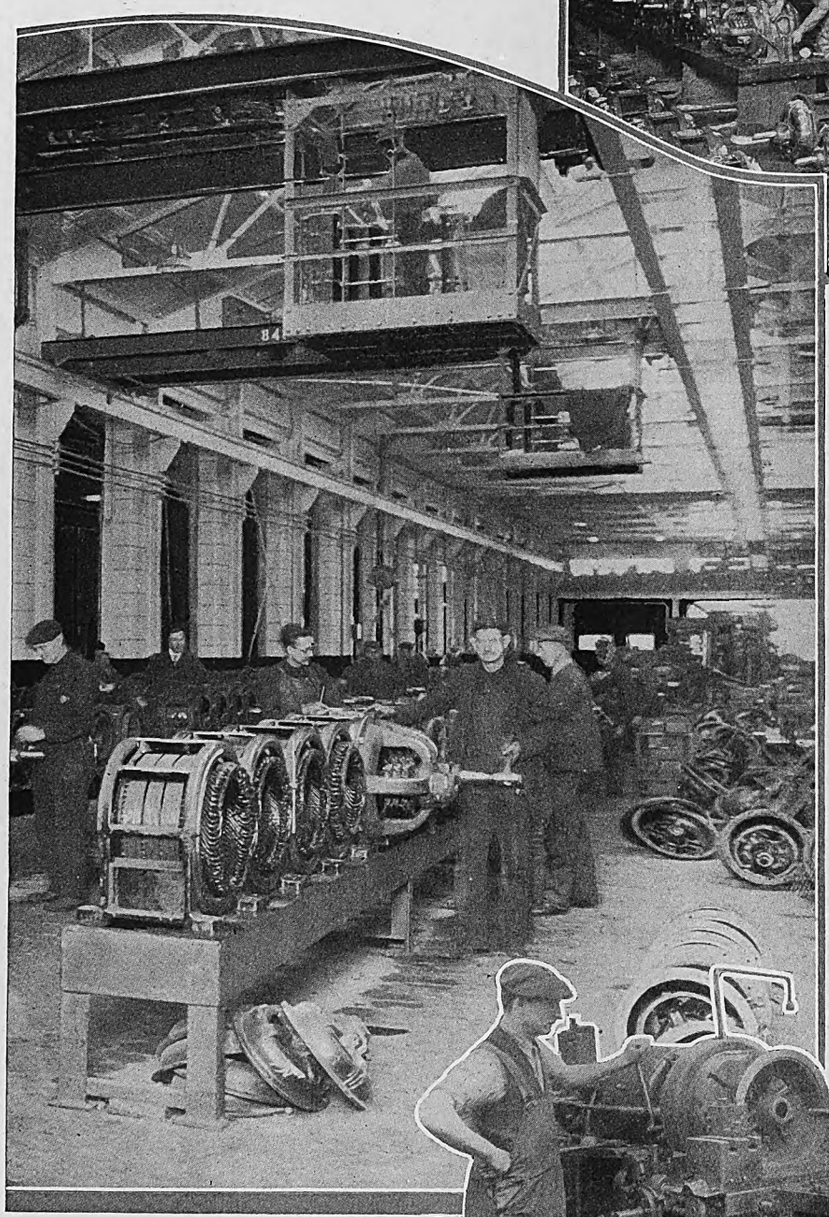


Fig. 11. Above is a view of the work of final assembly of complete motors. They are then ready for testing, inspection and painting.

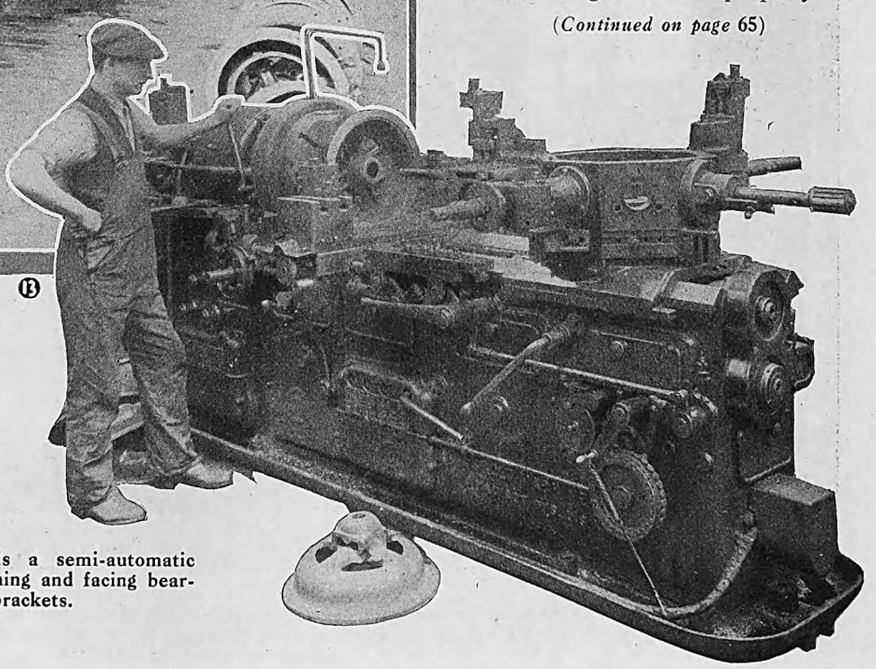


Fig. 13. Here is a semi-automatic lathe, boring, turning and facing bearing brackets.

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Industrial Housekeeping

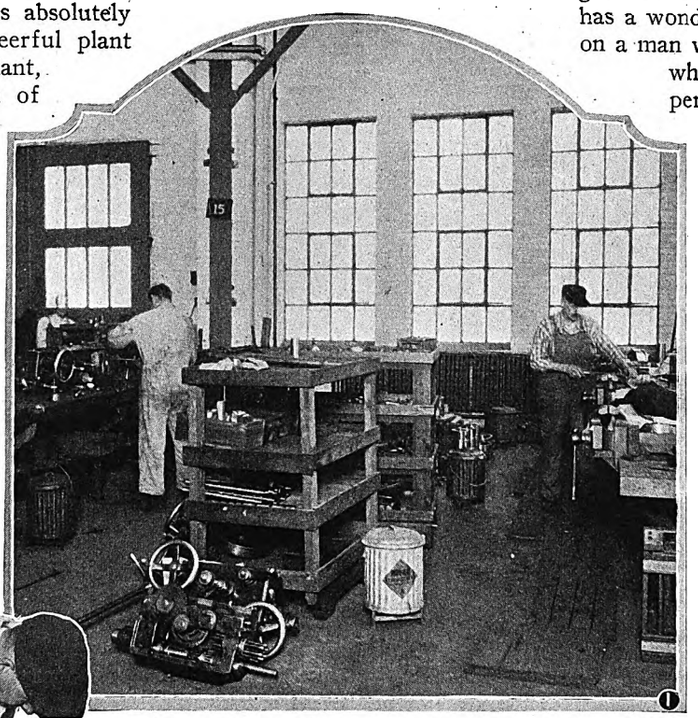
The Work of the Sanitation Department

By William G. Ziegler

PLANT sanitation is a broad classification covering the equipment, methods and materials necessary to preserve the health of the men. There is no question but that good sanitation pays, and if a plant is to operate at its highest efficiency, good sanitation is absolutely necessary. A clean, cheerful plant is usually an efficient plant, because the good health of the workers is bound to affect the amount and quality of the output. Most men spend the major portion of their waking hours at work and the conditions under which they work, in the various plants, affect their health to a larger extent than most people realize. It is to the employer's benefit to have a clean, sanitary plant because of better efficiency, and it is to the benefit of the men because of their better health. However, in spite of this mutual gain, cleanliness has not been given the attention it deserves.

It is easier to hold good help in a plant having good sanitation and it will attract more good help. A plant having drinking fountains, lockers, individual wash bowls, good toilet facilities and shower baths for departments needing them will have contented workmen and a high degree of efficiency. A shower bath has a wonderfully invigorating effect on a man who is tired and dirty and whose pores are all filled with perspiration and dirt. State codes usually specify the minimum requirements of urinals and closets, but it is best to have more rather than not enough, because if the men lose time waiting their turn in a toilet room the loss will more than cover a little added equipment.

When women are employed in the plant, entirely separate washroom and toilet room accommodations are necessary for them. As a rule the installation of up-to-date equipment for one group makes it necessary to provide as good accommodations for another group so that the general trend is toward complete high





Figs. 1 and 2. There is no excuse for leaving oily waste or cleaning rags where they may constitute a serious fire hazard. The use of approved containers is both a safeguard and a convenience.

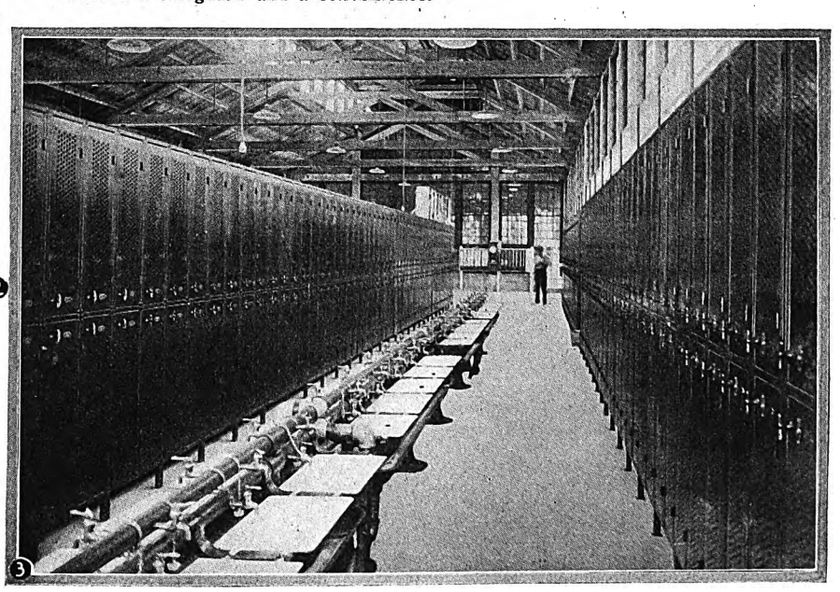


Fig. 3. At the right is a well arranged locker room and washroom with adequate facilities for a large force of men.

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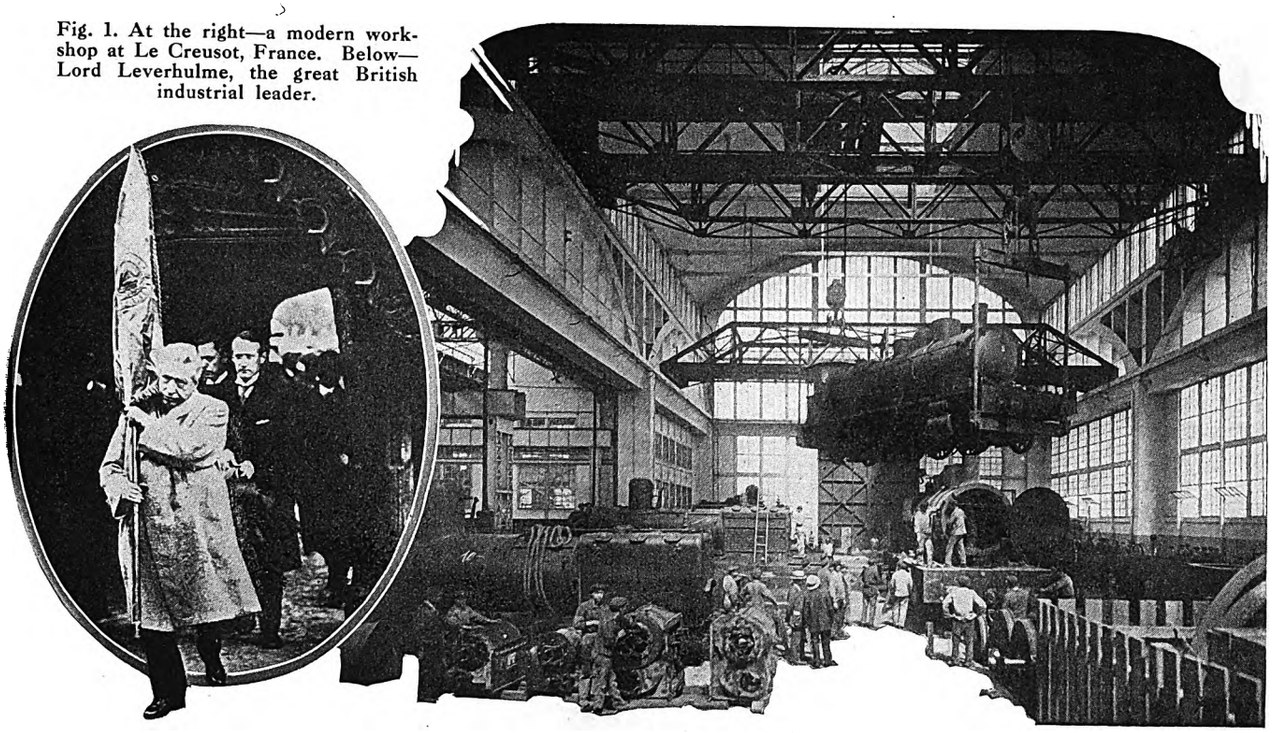


Fig. 1. At the right—a modern workshop at Le Creusot, France. Below—Lord Leverhulme, the great British industrial leader.

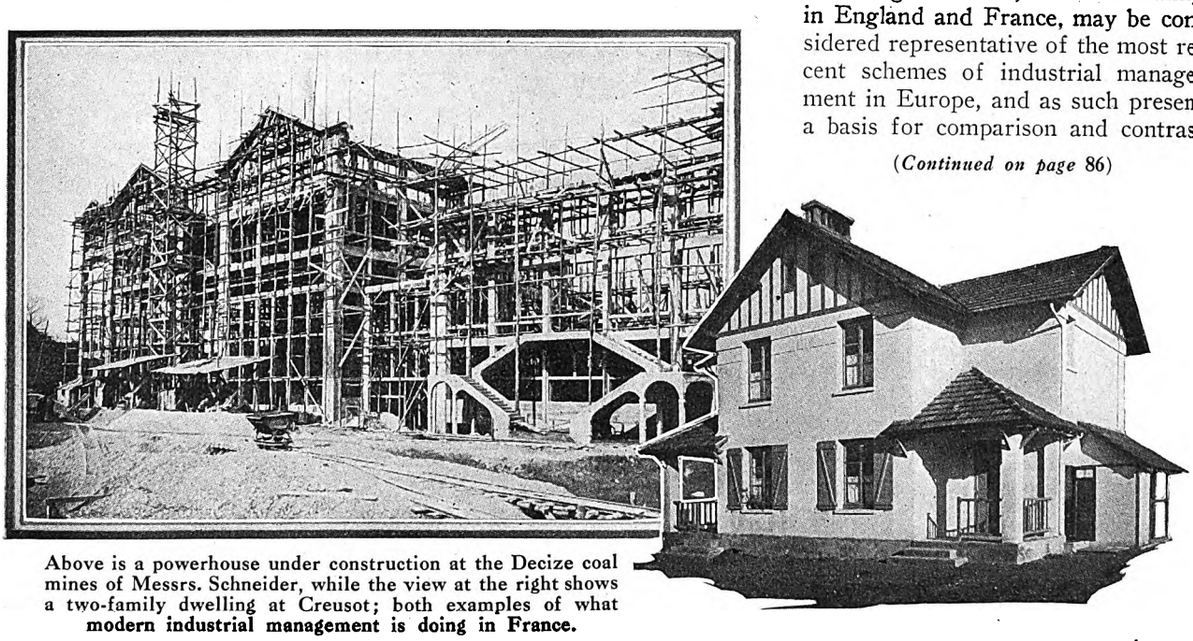
Modern Ethics in European Factories

A Review of Conditions Abroad

By Georges Benoit-Levy

IN this time of reconstruction, when industrial and commercial organization is of such importance, it may be interesting to present the views of the late George Cadbury and some of the European captains of industry to see to what extent their human ethics have reacted on their industrial prosperity. Problems and motives have been somewhat different in each case, but the following instances, selected mainly in England and France, may be considered representative of the most recent schemes of industrial management in Europe, and as such present a basis for comparison and contrast

(*Continued on page* 86)



Above is a powerhouse under construction at the Decize coal mines of Messrs. Schneider, while the view at the right shows a two-family dwelling at Creusot; both examples of what **modern industrial management is doing in France.**

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Concrete and the Modern Industrial Building

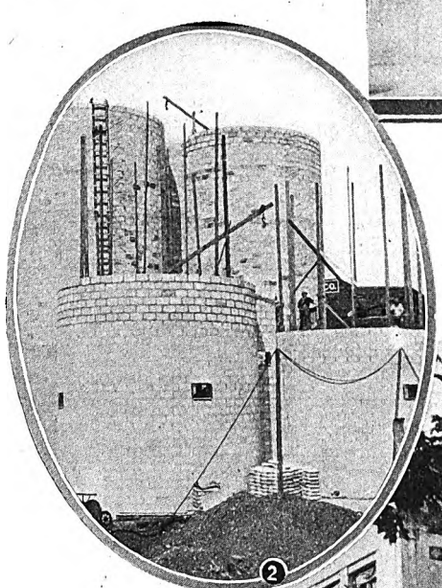
By H. Colin Campbell

AMERICA'S pre-eminent position in industry is not due to chance. Our industrial executives are the product of the school of experience. In this school they have learned that many factors influence balance sheets. Assets take on varied forms. For example, good will is often the principal capital stock of many an enterprise and its volume is such as to make its stated value in millions of dollars admittedly conservative. Every industrial executive knows that among the factors which contribute to the profits of his enterprise is proper plant quarters. Industrial buildings may be either a source of large direct profit to the enterprise or a heavy drain or menace to its resources that can wipe out its capital. For example actual tests to determine the influence of vibration of structure for certain kinds of occupancy have shown increased production because machines may be run at a higher rate of speed amounting to 15 or 20 per cent.

Financing and credits are seriously affected if an industry or business is housed in a structure that may readily be destroyed by fire. The ability of a concern to meet its obligations depends on as uninterrupted operation as possible. The fire that stops the functioning of an enterprise may not only affect its ability to meet its obligations promptly, but may make it impossible to meet them.

There are important losses resulting from fire that cannot be safeguarded against by insurance. These include losses resulting from suspension of business during which time capital investment is nonproductive. They include also the stoppage of production and loss of customers who seek other sources of supply, and frequently new business relations thus formed cannot be reclaimed. The efficient industrial organization of employees is broken up through the fact that many seek employment





Figs. 1 and 2. Two methods of using concrete for the construction of coal pockets; in the one case by poured reinforced concrete, and in the other by the use of concrete blocks.

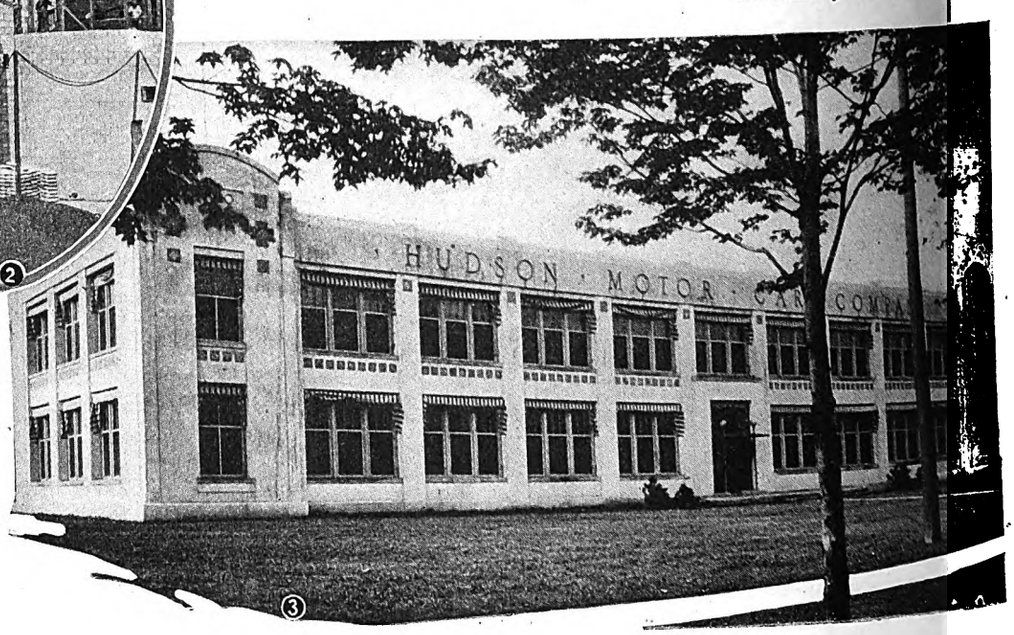


Fig. 3. An excellent example of the decorative possibilities of concrete construction.

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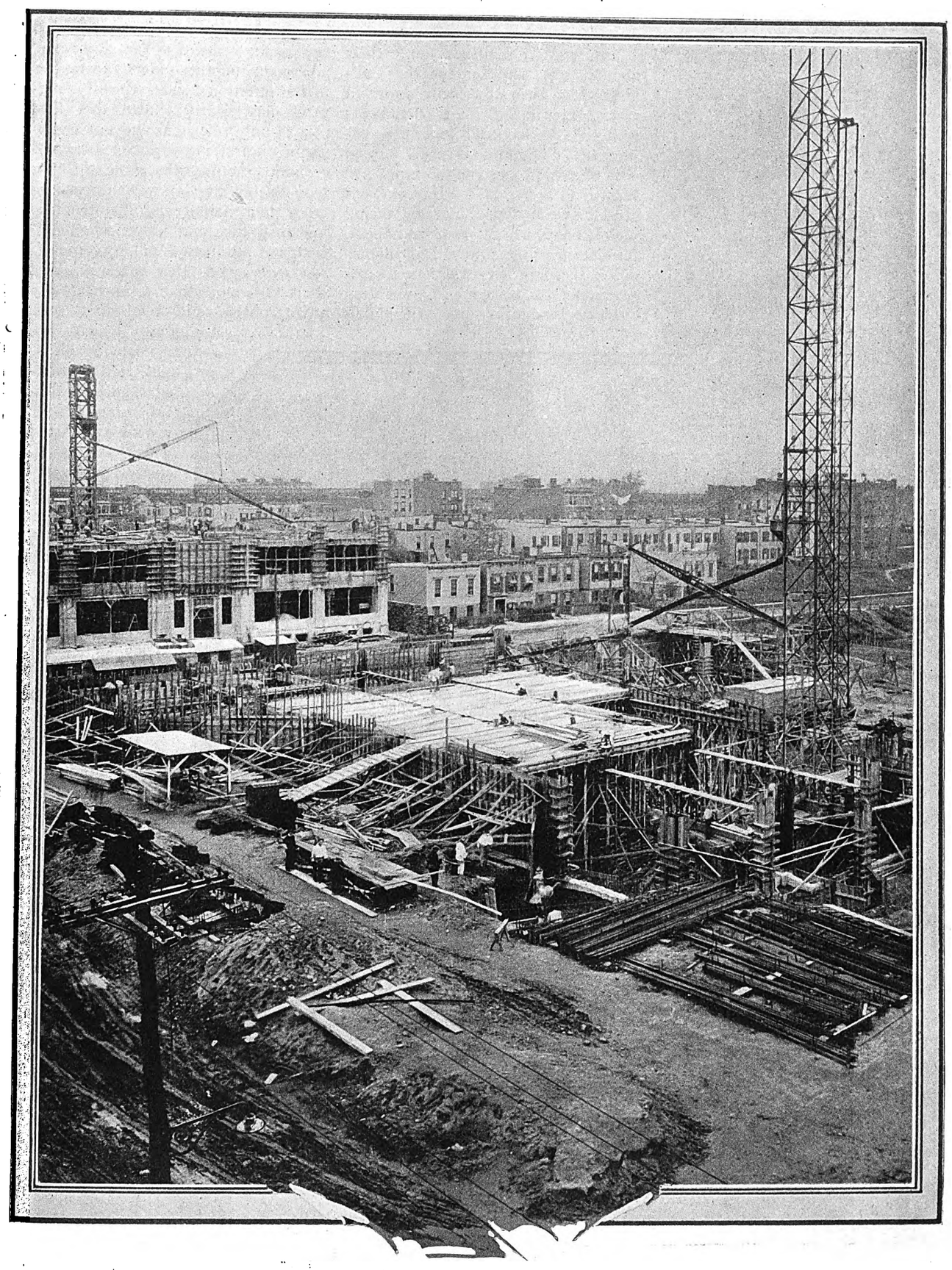


Fig. 3-A. The construction work on the Famous Players' studio, Long Island City, a structure where freedom from fire risk was of supreme importance.

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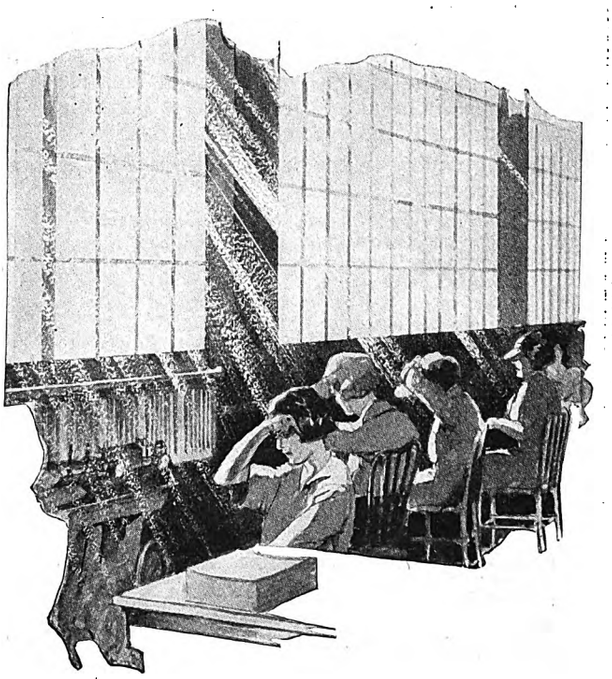
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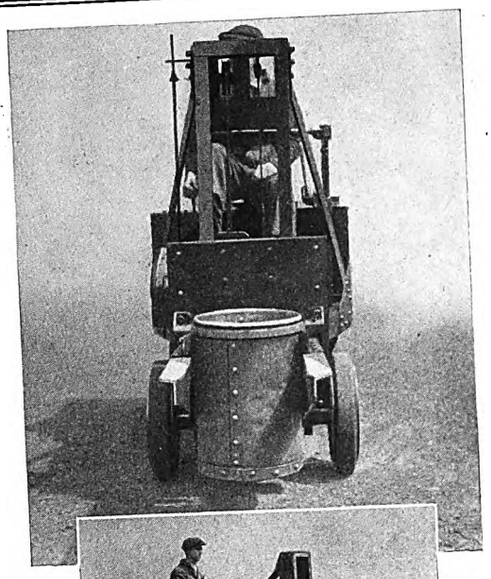
To convince you of how economically and effectively you can banish glare and reduce heat we invite you to accept this trial offer:

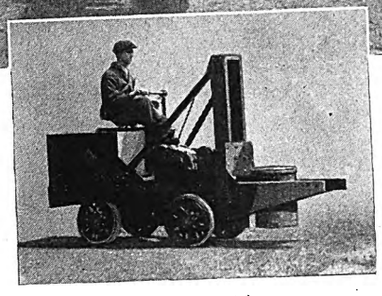
Order one gallon of Skyco No-Glare at $3.50 F. O. B. Cleveland. Use as much as you wish. Note how easily it is applied. Mark how it defies weather conditions. See how easy it is to remove when occasion requires. Check up how much better work goes on when glare is banished and heat lessened. Then, if you are not delighted, return the balance at our expense and we will cancel invoice.

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The ELWELL-PARKER ELECTRIC COMPANY

Cleveland Ohio

Concrete and the Modern Industrial Building

(*Continued from page* 36)

tractor's bid or of low cost in a cost-plus contract. It should not be supposed that the first cost of a concrete building will be greater than that of other acceptable types of construction, in fact concrete buildings designed for heavy floor loads have been built for less than any other practicable type would have cost.

A comparison of the initial cost of fireproof buildings will almost invariably show low cost of the concrete structure.

Buildings of various types are usually placed in the following order as to first cost, beginning with the lowest in cost.:

Mill construction
Concrete flat slab
Concrete beam and slab
Structural steel fireproofed.

In recent years, as everyone knows, marked changes have taken place in the materials and labor market but the net result, however, has been rather to cut down the difference in cost between mill construction and reinforced concrete instead of to increase it.

Business men now put the question—How long will it take to build?—farther to the front than ever before. Labor difficulties, shortage of transportation, desire to immediately increase production to meet an existing demand, and getting the capital invested in a building earning money at the earliest possible date have put a new value on speedy construction.

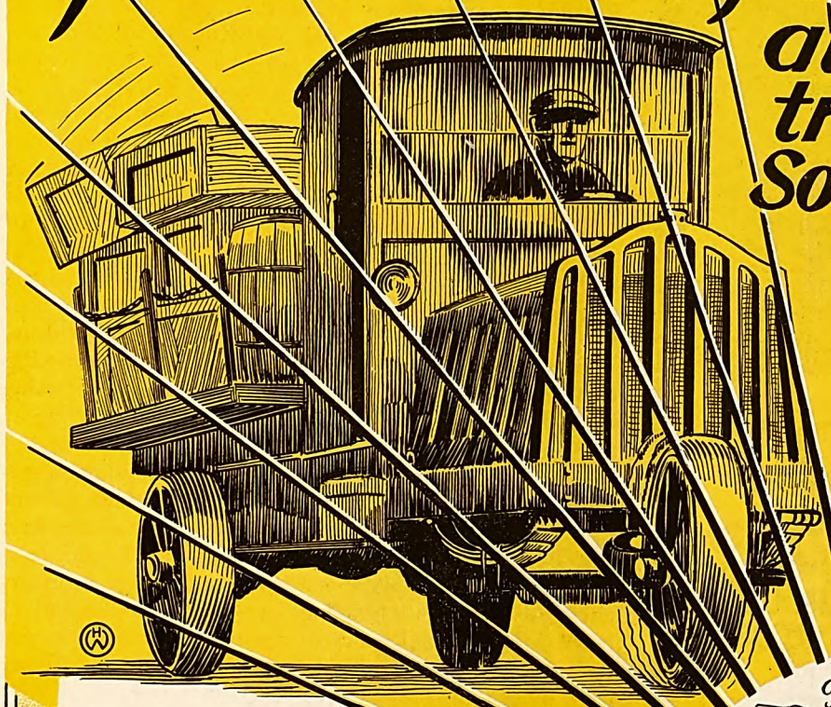
The comparative simplicity of concrete construction and the availability of necessary materials are reasons why, under equal conditions, concrete permits maximum speed of erection. An estimate of the value of high speed of construction from the standpoint of earlier occupancy, hence manufacturing operation, may easily be made. Assume a building costs $400,000, and money is worth 6 per cent. Assume also that two months may be saved in the time required to complete a building by using concrete. Not only would interest on the $400,000 be saved but there would be profit from the earlier active operation of the invested capital which would be at work two months earlier, and this is directly creditable to speed of construction. If investment in equipment and working capital to be devoted to operations in the building equals the cost of building, and the business nets 10 per cent. a year, it is worth $13,333 to get into the building two months sooner. Concrete construction may be carried on during the winter months when most other building operations are suspended or at best, advance with indifferent speed.

The total value of the fire-safe qualities of a building cannot easily be expressed in dollars and cents. It involves insurance on building and contents, the non-insurable loss always resulting from fire, influence on credits and invested capital, and the importance from the national aspect, of preventing waste of natural resources. Insurance rates differ greatly with the design, location and occupancy of buildings, yet it is true that the highest type of fire-resistive construction will carry the lowest insurance rate both on building and contents, all hazard and occupancy conditions being equal. Many

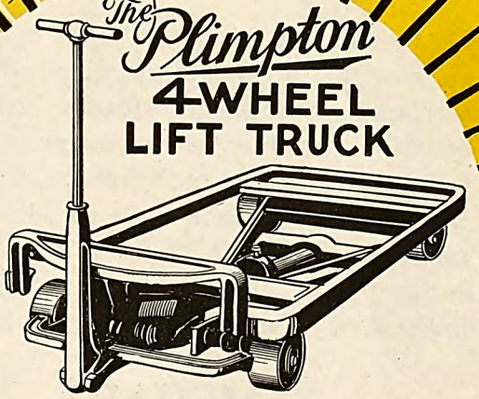
(*Continued on page* 40)

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You wouldn't buy a 3 wheel automobile truck - - - - So why should you buy a 3 wheel lift truck



The Plimpton 4-WHEEL LIFT TRUCK



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STABILITY Is What You Should Have in Lift Trucks

Plimpton Lift Trucks (built like an automobile) cradle the load, save strain on platforms and keep the load on—no joggling or falling off or breakage.

All wheels under the load, front wheels turning at an angle of 45°, the Plimpton operates in the narrowest of aisles allowing for the most efficient use of **floor space.**

With its four aligning wheels, its 4 point load suspension and right angle steering knuckles, the Plimpton solves the question of lift truck stability. Two front wheels mounted on a swiveling axle and turning under like carriage wheels are no better than one, when it comes to a right angle turn. Stability is most needed when turning corners.

Write for **"Facts"** giving in detail the many points of Plimpton superiority. Plimpton's have been sold for ten years to biggest executives throughout the world. An investigation of Plimpton Efficiency always results in their installation.

The Plimpton
LIFT TRUCK CORPORATION
Stamford Conn. U.S.A.

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(*Continued from page* 38)

owners of concrete buildings carry no insurance on their structures. Some insurance companies allow approximately 40 per cent. credit for concrete, and in general, insurance on a concrete building will be from 30 to 60 per cent. less than on a mill constructed building, depending on occupancy. Take for example a piano manufacturing plant on which the occupancy hazard may be considered high, the plant located in a city with fire protection, not exposed to other buildings and equipped with sprinkler system. Insurance on such a plant of mill construction will be about 28 cents per $100, while on a reinforced concrete building it will be about 10 cents per $100, or a difference of 18 cents per $100 in favor of concrete. A further credit is to be given the concrete building because of lower insurance on its contents, and in the above example the difference in insurance on contents will amount to about 23 cents per $100 in favor of the concrete structure. Assuming the value of contents as twice the value of the building, a saving of 23 cents per $100 value of contents would amount to 46 cents per $100 on the initial cost of the building. Capitalized at 6 per cent., these credits for insurance amount to $10.60 or approximately 10⅔ per cent. on the first cost, which should be credited to the cost of the concrete building. In other words, the advantage in insurance rates on both building and contents allowed because of reinforced concrete construction would in this case justify an expenditure amounting to over 10 per cent. more than the cost of mill construction.

Any industrial executive can apply the principles in the case above assumed to his own proposed building problem, to determine the actual savings that will result from fireproof construction. Knowing in general the nature and value of the occupancy of the structure, he can obtain from insurance companies a fairly accurate estimate of the actual rates that will be charged on a concrete building and on one of non-fireproof construction, and their contents. The difference capitalized at the current rate of interest will represent the actual saving in insurance from a concrete building. Insurance is usually written on only a portion of the value of the property insured. The remainder of the risk must be assumed by the owner. Ordinarily he is required to be a co-insurer to the extent of about 20 per cent. of the value of the property. For a concrete building this is a very small item and if the building has a non-combustible occupancy, no insurance need be carried on the building; in fact, the rates quoted for such risks when offered are so low as to represent merely the overhead expense of writing the insurance. Provision should, however, always be made for the co-insurance portion of all combustible mercantile or industrial buildings. In any fire, the greater the loss, the greater will be this uninsurable loss to the owner.

In a concrete building the concrete floors and walls confine the fire to the location of origin and reduce to a minimum the fire hazard. Moreover, concrete floors being waterproof, protect the contents of lower floors from damage due to water from sprinklers and fire hose.

Insurance covers only a part of the hazard and may be sufficient only to meet the obligations of the concern, the remainder representing the owner's personal loss. In many cases a severe fire in which the loss is practi-

(*Continued on page* 42)



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MEDART STEEL SHELVING consists of just a few standardized, interchangeable parts. Easily and quickly assembled or rearranged to meet changing requirements. Takes up less space than wood, is stronger, neater, more durable, and is fire-proof. The cost is surprisingly low. Write for catalog "S-7."



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There is no wobble to Truscon Steel Platforms—in fact you cannot overload them. The secret of their extraordinary strength and rigidity, is in the construction of the corner, where the depth of the reinforcing rib is actually deepest. This depth, together with the special formation produced by bending, results in a double reinforcement, which makes the corner the strongest part of Truscon Platforms.

The same rigid-rib construction used in Truscon Steel Platforms is the feature which makes Truscon Alloy Steel Boxes stand up under unbelievable rough handling and abuse.

Truscon Alloy Steel Platforms and Boxes, used together, give you an unsurpassed combination for cutting down non-productive handling and rehandling expense. Not only is the maintenance of Truscon Steel Platforms negligible, but accidents due to collapsing from overloading, are unheard of because of their integral construction.

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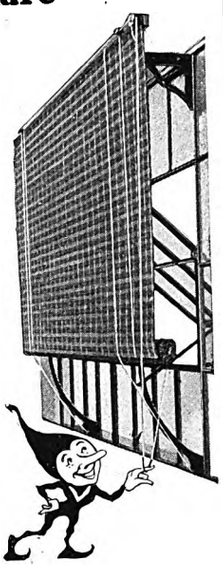
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Light and Air—
—Without the Glare

Light without heat and glare, and fresh air without draughts will increase the efficiency of your employees and add materially to your profits this year.

Secure these benefits for yourself and everyone in your employ now—equip with Ratox Shades. Suspended from enameled steel brackets which are secured directly to the steel sash, they are guided around the center swing ventilator and brought back flush to the wall, at the base, out of the way of machinery or workers—*independent action of center swing ventilator and shade.*

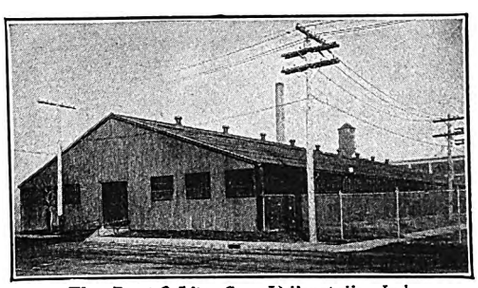
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(*Continued from page* 40)

cally total, marks the death of the enterprise. Total loss cannot occur if the industry is housed in a concrete building.

Maintenance of a structure includes cleaning, painting and such repairs and replacements as are necessary to keep the structure in a condition fit for use. Maintenance of those parts of a structure which can be replaced may be carried on indefinitely but the most vital structural parts of buildings do not admit of easy replacement, nor can all of such parts be reached with preservative treatments or coatings tending to preserve their useful life. It is therefore impracticable to maintain indefinitely, structures whose vital parts are subject to rust or rot.

Maintenance on a depreciable building grows greater from year to year, as do depreciation charges. With depreciation also comes a gradual, perhaps unobtrusive, but none the less real reduction in efficiency of operation.

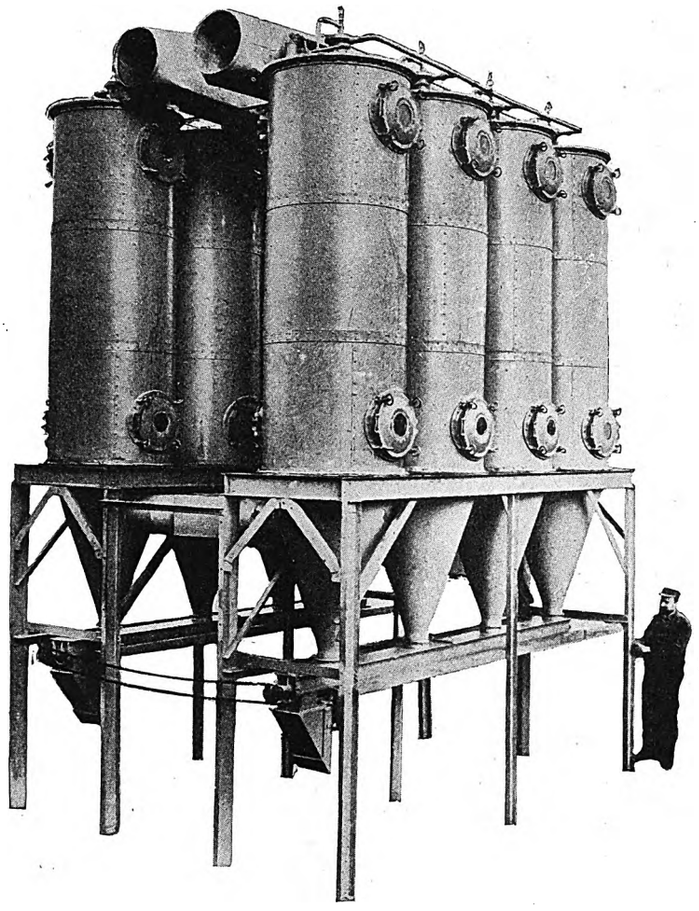
In comparing the economy of various types of buildings, maintenance may be taken as an average of 1 per cent. per year, of the cost of the building. This $1 per 100, capitalized at 6 per cent., shows that over $16 more per $100 original cost could be spent for the maintenance-free concrete building than for one of depreciable type. Yearly maintenance, however, is to be distinguished from gradual depreciation which, after a term of years, renders the structure unusable regardless of the maintenance done on it. In order to provide for financing the new building necessary at the end of a given term, a sinking fund must be set aside annually so that at the end of the building's usable life there will be an amount available equal to the initial cost of the building. Concrete buildings require no such sinking fund for their structural portions because their life is not limited by a decrease in strength through gradual depreciation.

Obsolescence may be described as the total loss of value for any useful purpose of a structure because of altered environment or because of conditions affecting manufacturing processes and desirability of location. Residence districts sometimes change to business districts. Industry in turn follows certain trends of city growth and development so that portions of a previous retail district may become a wholesale or warehouse district. In the course of time, the wholesale district becomes a loft or light manufacturing district or warehouse district. Warehouse locations may become undesirable by the opening up and development of new lines and means of transportation and discontinuance of the old. The development of new machinery for manufacturing processes may be such as to render buildings unfit for the operations for which they were originally designed and if the building cannot be adapted to some use under the new conditions, it is obsolete. Therefore a correct allowance for obsolescence requires a correct estimation of future conditions, together with the selection of a type of building that will best meet those conditions.

As concrete buildings are now designed, they have great reserve strength; that is, the unit stresses used in designing them are very much below the stresses to which concrete may be safely subjected, and since their strength increases with age, concrete buildings designed for mercantile purposes are likely to have the reserve strength necessary for other occupancies. In fact, a building possessing the required strength and freedom from

(*Continued on page* 44)

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DRACCO Perfecto Filters

Protect Your Property and the Health of Employes

Recovers all solids from gases of smelters, blast furnaces. Solves all dry dust collecting problems.

Dust is a dangerous explosive. Disasters have continually occurred in modern and supposedly fireproof plants. Many workers have been killed and the property loss has amounted to millions of dollars.

It is paramount that your plant be kept clean at all times; and that the air your employes are obliged to breathe be free from contamination.

The Dracco Perfecto dust recovery installation is the latest and best development of the pneumatic principle in dust collecting equipment. It solves the problem of handling fine, coarse, sticky or granular materials and will clean air or gases more efficiently than any other equipment.

Let us explain to you how Dracco can protect *your* property and safeguard the health of your workers.

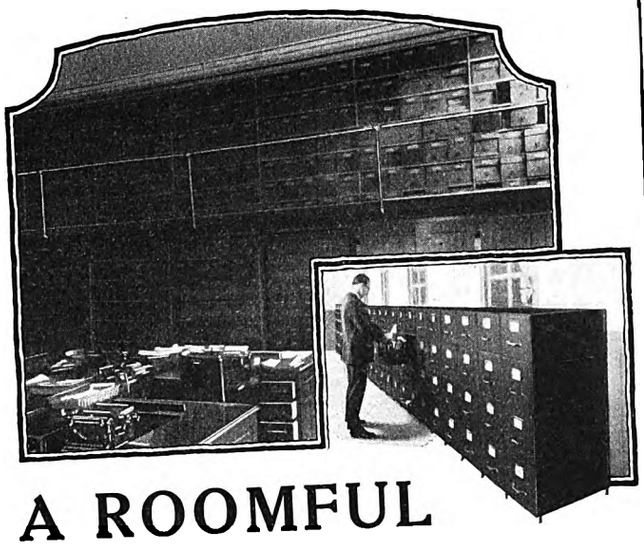
They recover solids from air or gas at a minimum cost, and within minimum space requirements.

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A ROOMFUL OF DOCUMENTS

Re-Filed in Van Dorn Transfer Cases

A CERTAIN prominent railroad office filed documents in boxes as shown in the upper picture. The system was fairly satisfactory, too. No one was urging a change.

But Van Dorn showed how the whole roomful of papers could be compactly filed as shown in the lower picture! Results: (1) Much room saved by tearing out old shelving; 2) Light of four windows made available; (3) Climbing ladder to balcony eliminated; (4) Neater appearance; (5) All files more quickly found.

The point is that, while *your* problem may be entirely different, Van Dorn can solve it too!

THE VAN DORN IRON WORKS COMPANY, Cleveland

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MASTERCRAFTSMANSHIP IN STEEL

(*Continued from page* 42)

vital depreciation may run the entire gamut of occupancy required by changing environment or manufacturing processes and thus escape death by obsolescence. Many cases are known of concrete buildings having been occupied by one after another of different industries ranging from mercantile to light manufacturing and loft to warehouse. These changing occupancies have often afforded interesting sidelights on the great strength of concrete buildings, as in the case of the Kindell Bed Co. building, Long Island City, New York. This was originally designed for 200 pounds floor load. Through changes of occupancy it became a warehouse for the storage of sheet tin, resulting in floor loads as great as six times those for which the floors were designed.

Any well built concrete structure may be used for light manufacturing purposes or for housing rapidly moving machinery. Non-inflammable occupancy may change to inflammable occupancy, a mercantile building to a warehouse, a warehouse to a manufacturing plant and vice-versa.

Adaptability or suitability concerns those qualities inherent to or easily secured in a type of construction which makes a building best suited to the particular occupancy proposed. While it is scarcely practicable to measure exactly the value of adaptability in dollars and cents, nevertheless some of the various qualities that go to make up adaptability are of great importance. It is manifest that buildings in which people work should be sanitary. Sickness, poor health and low vitality of employees affect in a vital way their efficiency and therefore the efficiency of the business or industry. The very nature of concrete buildings affords utmost sanitation.

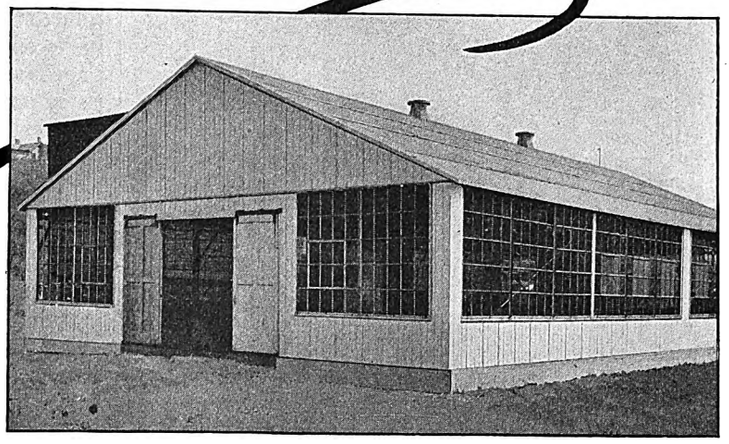
Sunlight is necessary to the preservation of ideal sanitary conditions. Ample natural light is also necessary to highest efficiency of operation—in fact it is vital to all manufacturing processes. As concrete buildings allow maximum lighting area, they meet these requirements and at the same time effect economy from the utilization of wall space for glazing, which costs less than solid wall construction. For all classes of buildings, natural light is an asset which will effect a saving in the cost of artificial lighting as well as add to the efficiency of operation and lower the cost of construction.

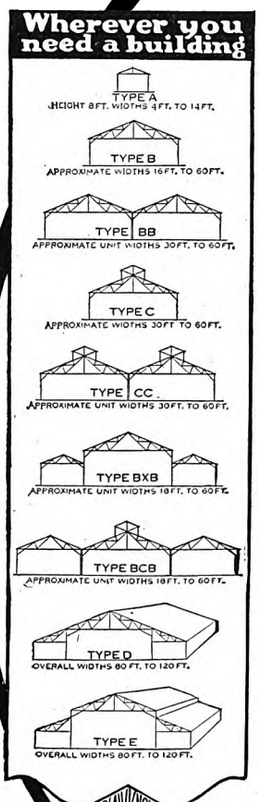
Industrial buildings, though primarily designed along utilitarian lines, may be given simple architectural treatment at a very small expense. Ornament is easily added in the form of concrete cornices or balustrades. Proper attention given to the selection of aggregates leading to special surface finish will result in pleasing effects. Stucco in considerable range of color may be used as a surface finish.

An exceptional degree of security from destruction of buildings and loss of life from tornado, earthquake and explosions is provided by the rigidity of concrete. The San Francisco earthquake and fire, the Baltimore fire, the munition shop explosion in Halifax Harbor, the Fergus Falls, Minn., tornado, earthquakes in San Domingo, Guatemala and Japan, and numerous other examples testify to the great resistance of concrete buildings against destruction or serious damage. Life and property are truly conserved by such structures and their occupants have the assurance at all times that they enjoy the highest measure of protection against the destructive forces of nature.

(*Continued on page* 46)

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SPEED at LOW COST

and Convenience in Financing

SPEED costs you nothing when you build with Blaw-Knox Better Buildings.

The standard pre-fabricated units, shipped from stock, are quickly in place. In a remarkably short time your building is in use.

First cost is low. Shop production, in quantity, makes possible many economies.

Yet long service is assured.

The steel is protected by a heavy coating of zinc. Not even a bolt hole mars this protective surface. Rust cannot gain a foothold.

Only in Blaw-Knox Better Buildings do you find this double protection.

Leak-proof skylights in the roof are another exclusive advantage offered by Blaw-Knox alone.

Storage buildings thus may have walls of steel, with no windows to encourage prowlers. Small shops may have light thru the roof in addition to that afforded by steel sash.

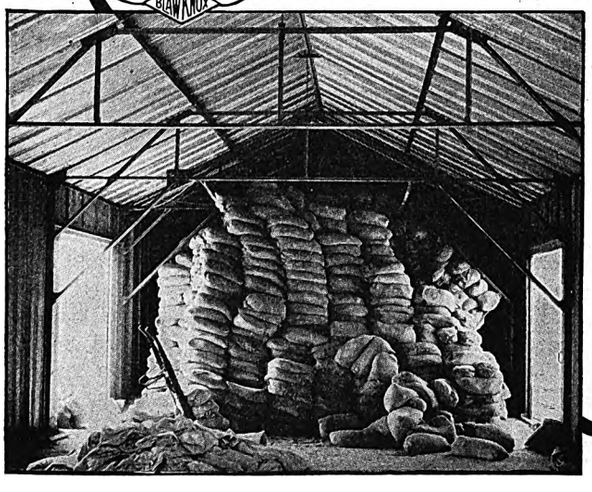
Hundreds of companies, some owning as many as seventeen Blaw-Knox Better Buildings, verify your wisdom in selecting these standard structures.

You Should Read These Booklets

"The General Manager Solves The Building Problem" outlines the practical application of Blaw-Knox Better Buildings. "The Blaw-Knox Building Finance Plan" clearly illustrates the "pay as you earn" service for large or small buildings. Read these books before you build. Let us send you prices and plans.

Pay As You Earn

Your low first cost may be spread over a convenient period. Blaw-Knox alone offers this "pay as you earn" service. You know the advantages of this convenience—how it solves the building problem without straining credit and hampering business. Ask for the details of our Building Finance Plan.



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1511 American Trust Building
BALTIMORE
Bayard and Warner Streets
BUFFALO
622 Genesee Building

BLAW-KNOX *Better* BUILDINGS

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HERE IS CHEAP PRODUCTION

Maehler *Multiple-Pass Conveyor Ovens, designed for quantity production of small parts with low labor, power and fuel costs.**

The loading and unloading requires but two girl operators. This conveyor automatically dips and bakes 1400 lbs. of castings per hour, 27,000 pieces per eight-hour day at a fuel cost of $2.00.

The results are typical of our cost reduction methods.

A Maehler *Multiple Pass** Oven fitted to your product will result in an immediate and decided operating cost saving. We will be glad to advise you.

These ovens are mechanically perfect, of high grade workmanship, and give uninterrupted service.

*Registered

The PAUL MAEHLER COMPANY
INDUSTRIAL OVEN BUILDERS
2218 W. LAKE ST. CHICAGO, ILLINOIS

Maintain Your Floors Without Interrupting Production

Quickfix

48 Hour Concrete Floor Patcher

QUICKFIX makes a concrete patch of flint-like hardness, ready for traffic *in only 48 hours.* Ordinary concrete patches block traffic and delay production for ten to twenty days while they harden. With QUICKFIX *you can patch the floor Saturday and open it up to traffic Monday.* Any handy man can use it. No costly delays or interference with plant's operation.

Patch those holes *now*—before they get larger. Don't run the risks of injuring workmen, damaging valuable materials, and slowing up production. Use QUICKFIX and eliminate the danger spots quickly. Send for our QUICKFIX BOOKLET with full details. Show your organization what efficient maintenance means.

SANISEAL—Gives any dusting, crumbling concrete floor, old or new, a wear-proof, dust-proof surface. Get our SANISEAL BOOKLET. SANISEAL without SHUTDOWN.

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Factories: Cleveland & Irvington
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THE MASTER BUILDERS COMPANY
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Gentlemen: Send us complete information about:
Quickfix--for making permanent wear-proof concrete patches in 48 hours. We have _____ Sq. Ft. to repair.
Saniseal -- to harden dusting concrete surfaces.
Name _____
Address _____

Maintain Your Floors Without Interrupting Production

(*Continued from page* 44)

Buildings whose occupancy requires the use of rapid moving or reciprocating machinery deserve special consideration as to structural material. Machinery once anchored, adjusted and aligned in a concrete building will stay put. Alignment of shafting and adjustment of machines is held correct and the service as well as efficiency of machinery is increased thereby. Experiments have established the fact that printing presses may be run 20 per cent. faster and shoe manufacturing machinery, 15 per cent. faster in vibrationless buildings than in those not free from vibration. Designing engineers who specialize in textile mills have chosen reinforced concrete as the superior type because of its freedom from vibration and maintenance.

As the yearly turnover or total value of business in an industrial building often amounts to several times its first cost, an increase in production of as much as 15 or 20 per cent. may equal a very large portion of the total first cost of the structure.

Warmth and dryness are qualities generally desirable in all buildings. These may easily be obtained in a concrete building. In general, warmth and dryness depend on insulation, that is, upon the effectiveness of retarding the passage of heat. Concrete, even without the aid of insulating materials, is a poor conductor of heat and when used either with insulating membranes or by providing dead air spaces, possesses ideal insulating qualities. Both of these methods of securing insulation are easily carried out with concrete. The usual inside finish of furring lath and plaster furnishes the necessary insulation to prevent condensation of moisture on the walls and adds its resistance to the passage of heat to the resistance furnished by the concrete walls themselves. No moisture passes through dense, well built concrete. Because of these qualities, concrete buildings are easily kept warm in cold weather and comfortably cool in warm weather.

Buildings designed to house industries requiring special machinery should be planned to obtain the most efficient production and utilization of space. The general occupancy is usually known beforehand and the arrangement of machinery, location of elevators, shipping, receiving and other handling facilities can be well worked out and provided for in the design, which should also provide for anchoring machines, supporting shafting and similar details. In those cases where the occupancy is not fully known or where it is desired to provide for change in occupancy, insets and grooved channels can be placed at suitable intervals to anticipate for a variety of machinery arrangement. If for unavoidable reasons, changes or alterations in concrete buildings are necessary, they can be made with surprising facility when undertaken by experienced workmen with suitable tools and appliances.

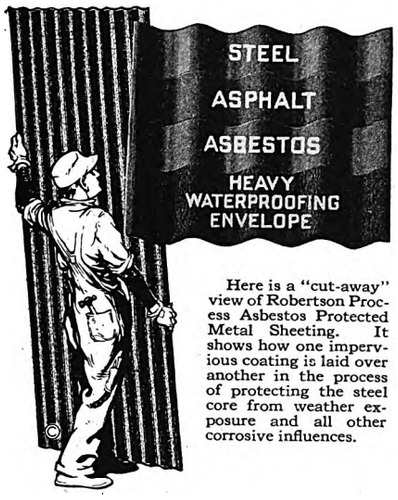
Actual savings resulting from a concrete building when compared with one of less firesafe materials have been pointed out. It has been found that the capitalized saving on insurance and maintenance on a concrete building as against one of combustible, depreciable nature may be as high as 25 per cent. Whatever difference there may be between first cost of a fireproof reinforced concrete building and one of combustible type is certain to be returned to the owner in a brief period of years through these savings, after which they are all gain. The unavoidable depreciation of a building for perishable mate-

(*Continued on page* 48)

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Why Go Through This Every Few Years?





Here is a "cut-away" view of Robertson Process Asbestos Protected Metal Sheeting. It shows how one impervious coating is laid over another in the process of protecting the steel core from weather exposure and all other corrosive influences.

Some Prominent Users of APM

	First order	
Bethlehem Steel Corp.	1910	80 orders
Davison Chemical Co.	1908	76 orders
General Chemical Co.	1909	133 orders
Hudson Coal Co.	1918	65 orders
Pennsylvania R. R. System	1909	120 orders
Standard Oil Co and Subsidiaries	1912	155 orders
United States Steel Corp.	1909	318 orders

Why go through the trouble and expense of repairing or replacing worn-out roofing and siding every few years? This year replace your deteriorated building coverings with a *permanent* material. Do it with Robertson Process Asbestos Protected Metal (APM). Then you will be done with costly repairs, painting and replacements for years to come.

Put your replacement problem up to Robertson Engineers. Without obligating you in any way, they will make a careful survey of your requirements and submit recommendations and estimates covering the *permanent replacement* of your perishable roofing and siding with Asbestos Protected Metal.

APM is a permanent building material in every respect. It is a steel roofing and siding sheet made rust, weather and corrosion proof by three impervious protective coatings (1) Asphalt, (2) Asbestos Felt and (3) Waterproofing. It will deliver years of service under the most adverse conditions without requiring painting or repairs. It successfully resists the destructive action of smoke, steam, fumes, gases—all the corrosive influences that shorten the life and usefulness of less durable materials. **And the cost of APM is less than that of any other material of equal permanence.**

Perhaps you need a complete new building—a permanent building—yet one that can be erected quickly and economically. Robertson Engineering Service and Robertson Building Products are ideally adapted to the roofing and siding requirements of a structure of this kind. Let us give you complete information. The coupon is for your convenience.

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Factories: Ambridge, Pa.; Sarnia, Ont., and Ellesmere Port, Cheshire, England.
Branch Offices: In all principal cities in the United States.
For England: 110 Fenchurch Street, London E. C. 3. *For Canada:* H. H. Robertson Co., Limited, Sarnia. General Sales Agents for Canada and Newfoundland: B. & S. H. Thompson & Co., Limited, Montreal, Toronto, Winnipeg, New Glasgow, N. S. and Vancouver, B. C.

Asbestos Protected Metal *for* ROOFS *and* SIDING

Architects, engineers and plant owners will find interesting and valuable information in our advertisements in Sweet's Architectural and Sweet's Engineering Catalogs..

ROBERTSON PROCESS METAL PRODUCTS

H. H. ROBERTSON CO.
Pittsburgh, Pa.

I would like complete information regarding the PERMANENT REPLACEMENT of worn-out roofing and siding with Asbestos Protected Metal.

I am planning the construction of a new..... building. I would like to know the cost and advantages of covering this building with APM.

Name.....

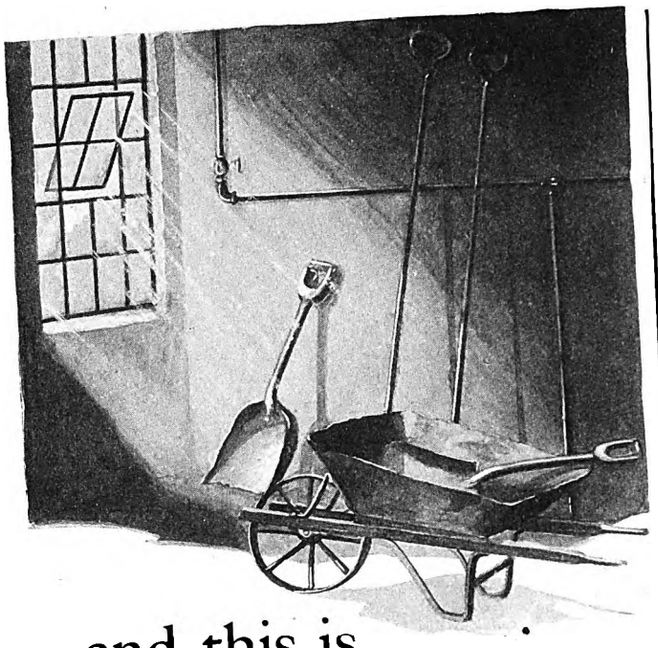
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Address.....

City .....

State.....I.I. 6-24

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---and this is the age of machinery!

THESE are the tools of hand firing—still in use in an age of invention—often in plants that boast of labor saving machinery. They are expensive tools. For although their first cost is negligible, the firing method they represent costs the plants where they are used thousands of dollars annually.

When hand firing is replaced by mechanical stokers, installed to exactly suit load and fuel conditions by the engineering staff of a responsible stoker manufacturer, a reduction in labor costs of forty per cent. or more is not uncommon. And this economy is added to the saving of coal produced by scientific combustion and the increase in boiler output produced by higher burning rates.

These and other dollar saving advantages of mechanical stoking are fully explained in the interesting book, "Coal—the *Basic* Fuel." Sent free upon receipt of your request to the Secretary of the Association.

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Ten cars of coal—or nine?

Mechanical stokers save coal by increasing furnace efficiency. They also make it possible to burn cheaper grades and sizes of local coal. Ten per cent saving is a conservative estimate.

Five men or three?

Stoker firing will cross at least two men off the pay roll if adopted by a hand fired plant now requiring five men. The better working conditions appeal to a better, steadier class of men.

Four boilers or three?

Greater steam demands can be met without adding to your present boiler equipment. Three boilers can be made to do the work of four through the higher combustion rate made possible by—

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BURN COAL

The Basic Fuel

STOKER MANUFACTURERS ASS'N

G. A. Sacchi, Secretary, Lester Branch, Philadelphia

I. I. 6-24 M-RTG

(*Continued from page* 46)

rials in its structural parts must be provided for by a sinking fund which at the end of the useful life of the building will be sufficient to replace it in kind. Obsolescence may require the removal of a building or a change in its occupancy before the end of its natural life. The great strength of concrete buildings fits them for changes in occupancy or even removal to some other desired location, so depreciation through obsolescence need not be charged against them. Also, change of conditions must be extreme to compel the demolishing of a building that may have its occupancy changed or be moved to defeat obsolescence. In such cases the increase in value of the ground space will more than compensate for the loss. It appears therefore that sound financing requires a sinking fund charge on non-permanent, depreciable buildings and none on a permanent, non-depreciable one. This procedure may be said to be without exception for many locations of industrial buildings because of natural surroundings or of zoning laws fixing the location of industrial enterprises.

Summing up the economic features discussed, we find that:

1. Savings from insurance and maintenance alone are sufficient to warrant an expenditure of one-third more for a non-depreciable, permanent concrete building than a depreciable one would cost.

2. Concrete buildings suffer no depreciation in their structural parts. They escape obsolescence through adaptability to change of occupancy and their fitness to be moved, and no sinking fund need be provided for them. From 10 to 15 per cent. more may be spent for such a building than for one whose service life is limited. Depreciation requires a sinking fund sufficient to equal the original cost of the building at the end of its service life, which must be provided for non-permanent, depreciable buildings.

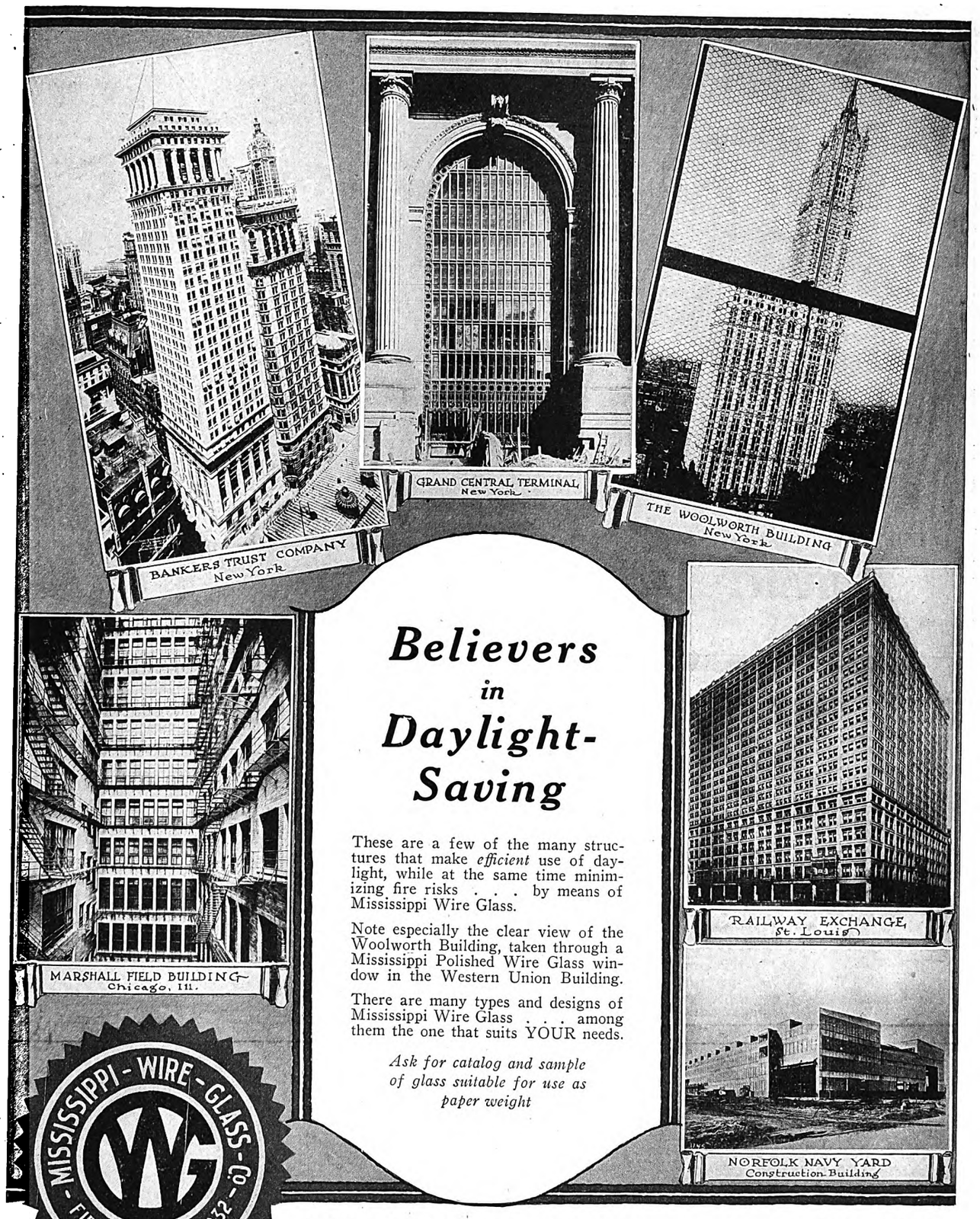
3. Efficiency of operation in vibrationless, well lighted, sanitary, comfortable, concrete buildings is certain to yield a considerable annual return on the first cost of the building, often higher than 6 per cent. Strictly speaking, this would mean that double the amount might economically be spent for such a structure.

4. Concrete's first cost is reasonable, less financial hazard is involved in construction, and a direct saving results from speed of construction and earlier occupancy.

The ultimate economy of the highest type of industrial building—reinforced concrete—will be shown in any reasonable comparison.

The most striking commentary on the acceptance of concrete as a standard is furnished by the buildings already constructed to house enterprises in practically every line of industry, and particularly in the numerous cases of those firms which, after their first use of it, specify concrete for all additional construction.

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The Speedometer of Industry

The Productimeter

Just as the speedometer shows how fast you are going, or should go, so The Productimeter on any machine in your plant tells how fast it is being operated—how fast it should be operated; how much it is turning out—how much it can turn out.

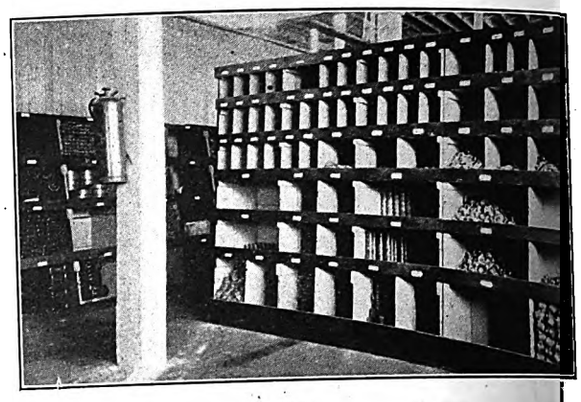


Try one ten days—free

DURANT Manufacturing Company

608 Buffum St. Milwaukee, Wis.

(2575)



Efficient Store Rooms

By Ernest Cordeal

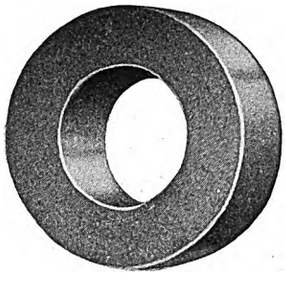
THERE is no better place to start a campaign for improved factory efficiency than in the store room. The manner in which the stock is kept and the system with which its movement is followed have a great deal to do with the efficacy of any production system which may be introduced.

The first essential of an adequate store room is sufficient space and convenient arrangement. The factory manager who crowds his store room off into some small, dark, inaccessible corner is making a grave mistake which he will pay for many times over in constant delays and errors in the delivery of material and in unexplainable accumulations of dead stock. In a factory of any size the quantity and weight of materials which daily move in and out of the store rooms is considerable and an arrangement which permits the parts to be delivered to and from the shelves and bins directly from trucks or floor boxes will usually save in handling labor alone more than the floor rent of the additional space required over a crowded department where materials must be slowly and laboriously handled by hand.

Good lighting is another important factor of the well appointed store room. When it is possible for the stock keeper to see pattern and part numbers in any part of the room much time will be saved in filling orders and many costly errors will be avoided.

Planning the bin arrangement for the store room is a task for the plant engineer in conjunction with the production manager. The bins should be of the proper size and shape to hold the maximum necessary supply of the parts for which they are intended as indicated by the manager's schedule of production. Obviously the large and heavy parts should be given space toward the bottom and the lighter, smaller parts at the top of the bin sections. It is usually more convenient and certainly makes a better appearance to build the sections wide at the bottom and narrower at the top. Very deep bins for small parts, which are present when the sections are straight up and down, makes them very inconvenient to handle rapidly.

The weakest point in most small and new factories is in the proper handling of and accounting for materials. Many companies new in the manufacturing game have gone bankrupt primarily for the lack of system and order in the matters of purchasing and taking care of their materials of production at a time when, in most instances, sales can no more than cover unavoidable expense.



Crushing Economy *from* Rolling Rings

for

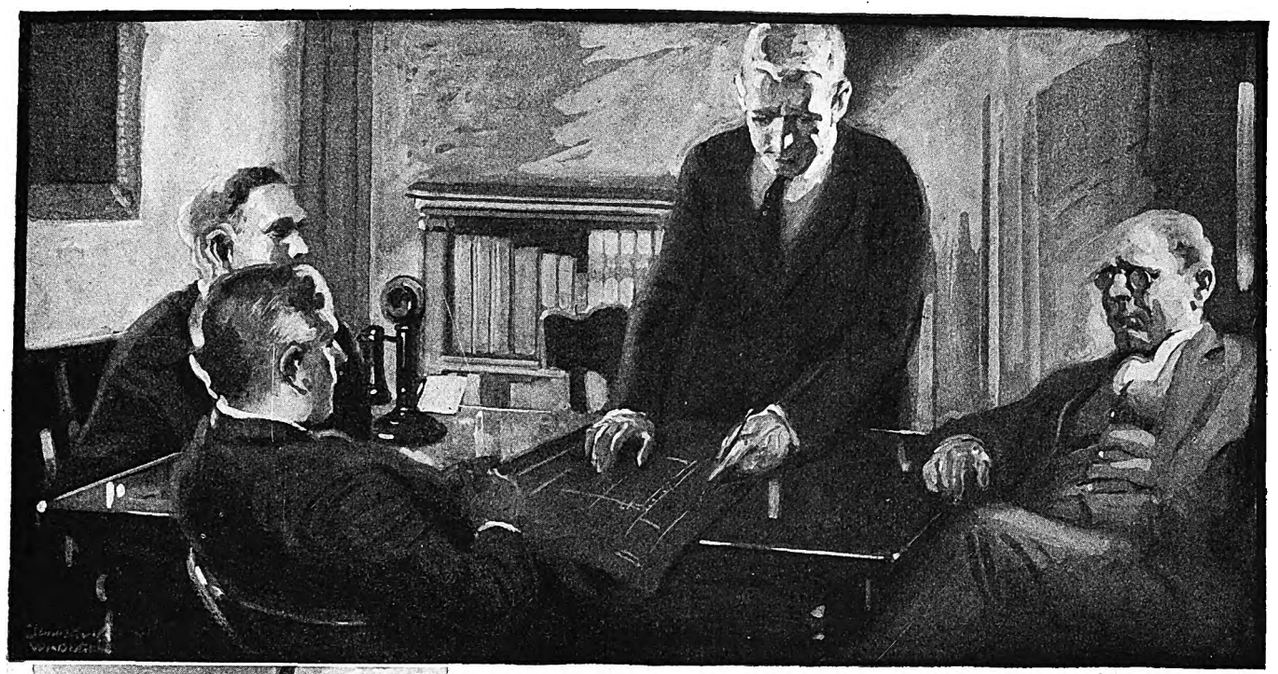
Coal
Clay
Steel Turnings
Brickbats
Limestone
Silica-Sand
Shale
and 11 Other Materials

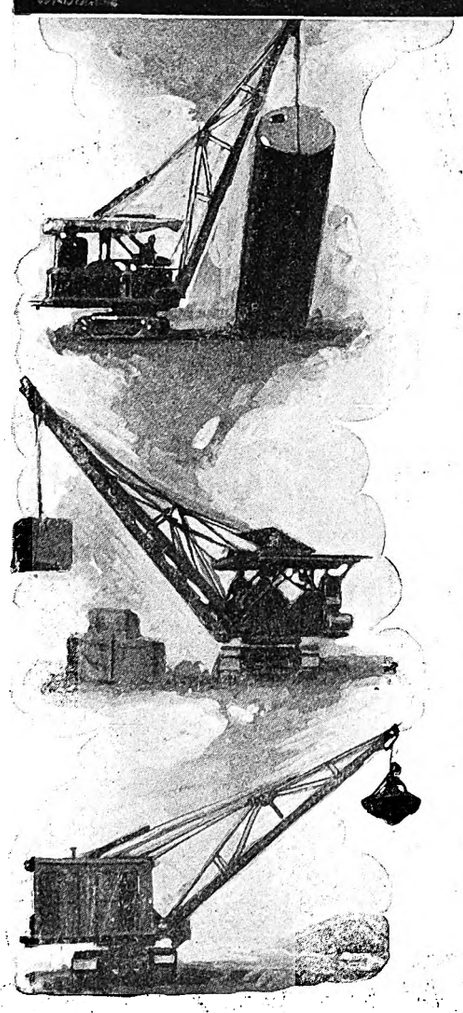
ONE company has cut down its per ton coal crushing cost to one-third the former cost. Another company that handles shale and clay, says its crusher is working as well after 12 years service as when it brought new economies during its first year. A third company that reduces steel turnings claims the crusher pays for itself every five months. No matter what you crush, the rolling rings will do it at the lowest possible crushing cost.

American Pulverizer Co.
18th and Austin Sts. St. Louis, U. S. A.

AMERICAN RING CRUSHERS

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Ideal for Irregular Shaped Yards

"Our plant and yard layout is peculiar," explained the superintendent, "here's this long narrow stretch—over here is a pie-shaped yard; with that main portion, wide but short. Yet we wanted to have every part served by material handling equipment.

"Henry suggested calling in a P&H representative and since his company makes all types of cranes, his recommendation as to what type would serve us best was worthy of consideration.

"To make a long story short, with the information he gave us it was a simple matter to see that the P&H Corduroy Crane, because of its ability to maneuver anywhere, and its ease of handling, was the type of equipment most efficient for our purposes.

"The two we ordered will be here in three weeks."

"That suits me," interrupted the G. M. "If these Corduroy Cranes are half as good as the eight P&H Traveling Cranes we have had for the past 18 years, we will get a bigger return on our investment than from any equipment or security I can think of."

* * *

One operator only is required on the P&H—electric or gasoline motor power is provided—maintenance is low because of the high quality of P&H design and construction. Bulletin 40-X shows many illustrations of the P&H operating with grab bucket, magnet, and chain slings. Mailed on request.

Pawling & Harnischfeger Co.

Established in 1884

3850 National Avenue, Milwaukee, Wis.

New York	Chicago	Pittsburgh	Philadelphia
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P&H CORDUROY CRANES

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Hot Jobs!

Cool These Spots with A Man Cooling Fan

You have jobs where men swelter and sweat; where labor turnover is high and costly because the men won't "stick." Here is a remedy for this condition.

The American Blower Man Cooling Fan will temper these hot spots with a current of cool, fresh air. In place of a sweltering gang of discontented men you will have a crew that works in comfort. The men will "stay put".

The effects of a man cooling fan can be felt a hundred feet away. It can be so placed it will cool an entire room—or the strong current of air can be played directly upon a particularly hot job.

Install a Man Cooling Fan and you will rob summer of its toll on your production and pay-roll. Literature on request.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

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Industry's Debt to Materials Handling

(*Continued from page* 18)

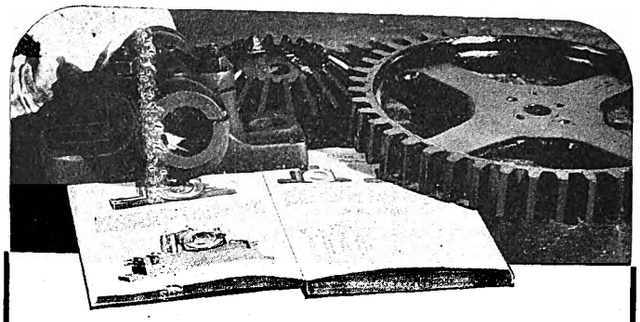
On our system of Great Lakes many steamers have been equipped with elevators and conveyors so as to make it unnecessary to employ manual labor for their unloading. These ships are used mainly for the handling of bulk materials, such as lime, coal, ore, etc., and not for the handling of miscellaneous freight. Other ships have not been so equipped but the docks and elevators receiving bulk materials by boat have installed many mechanical devices to reduce handling costs and to permit quick ship turn-around. Fig. 6 shows the business end of a mechanical unloader operating in the Port of Buffalo; this bucket, each time it drops into the hold of the ship, picks up seven tons of material and as the bucket can be loaded and emptied a number of times each minute it will be seen that the cargo can be quickly handled. Fig. 20 shows a general view of the same equipment and illustrates how two buckets are used simultaneously to unload the ship. Many other devices are also used for the same operation and there are a number of ports and terminals which are at the present time investigating these devices. What would the steel industry do without mechanical unloaders? Imagine for yourself the cost of steel if all the raw materials had to be loaded to and unloaded from the ships by hand. Who is profiting the most by the installation of this equipment? It would be indeed difficult to say, for while the steel industry is able to make better profits if they employ modern handling methods the consumer and individual is also able to buy good steel at a low price for the same reason.

On the unloading of miscellaneous freight the equipment is necessarily more diversified because of the assortment of packages to be handled. At many ocean ports and lake ports, mechanical ramp conveyors, as shown in Fig. 22, have been installed to overcome the difficulty of accommodating the conveyor to the rise and fall in tide and the difference in elevation which occurs as the load is lightened and the ship rises in the water. On piers and docks where these devices are installed the men operating hand trucks no longer need to pull and haul heavy loads up steep inclines, for by simply stepping on the moving platform they and their loads are quickly transported from one elevation to another. These same ramp conveyors are reversible in direction of travel and can be used to assist in loading.

The platform and large electric lift truck, shown in Fig. 3, is also playing an important part in the handling of miscellaneous merchandise on docks and piers. The size of this platform permits several slings of materials to be delivered direct from boat tackle to storage space without rehandling and as the truck operates on the lift truck principle it is possible for one truck to supply the motive power for a number of platforms.

Fig. 15 shows further use of conveyors in connection with ships. Here we see an installation of materials handling equipment for coaling passenger and freight vessels. At one time ships had to wait on the coaling operation but mechanical devices now deliver coal to ships as fast as they can take it. The installation illustrated is on one of our most important waterways, namely the Panama Canal and each of the loaders shown

(*Continued on page* 56)



Get This Valuable Book!

Medart Catalogue No. 43 includes tables for computing strength, horsepower capacities and sizes of shafting for various needs. Suggestions are made for the most advantageous use of couplings, hangers, bearings, clutches, pulleys, rope drives, etc. Rules are given for figuring gear speeds and diameters. These and many other facts make it a very valuable book. Well illustrated. Convenient pocket size.

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MEDART

Everything in Line Shafting Equipment

"Medart" means everything in line shafting equipment—shafting couplings, collars, hangers, bearing supports, gearing, friction clutches, rope sheaves, belt tighteners, fly wheels, etc. Immediate service—always—on your everyday transmission requirements.

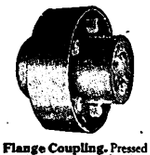
Submit specifications for estimate.

THE MEDART COMPANY

(*Formerly Medart Patent Pulley Co.*)

General Offices and Works, St. Louis, U. S. A.

Offices in Chicago, Philadelphia, Pittsburgh and New York
Office and Warehouse in Cincinnati



Flange Coupling. Pressed on shaft ends and faced to insure accurate alignment.



Drop Hanger. Double brace, four-way adjustment, with either ring, collar, wick or plain oiling bearings.

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these tools more productive work

INSTEAD of being tied up on back-breaking tasks, clogging the supply of available labor and retarding production, the men who used these tools are on better jobs—earning more for themselves and the company.

Let the tools accumulate rust rather than your men. Every workman you promote to more productive work helps solve the labor shortage problem.

Jeffrey Material Handling Machinery is liberating labor for more important work, is speeding production and simplifying manufacturing methods in large and small plants everywhere! Any or all of the following Jeffrey Equipment may be of interest to you:

Conveyors, Elevators, Portable Loaders and Unloaders, Crushers, Pulverizers, Chains, Coal and Ashes Handling Machinery, Industrial Locomotives, etc.

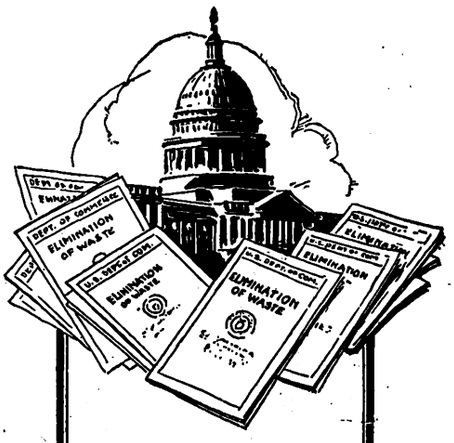
A communication to this office or to any of the Jeffrey Branches will receive prompt attention.

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Material Handling Equipment is advocated by the Division of Simplified Practice, Department of Commerce, at Washington, as one of the factors that contribute to the elimination of waste in Industry.

Users of such equipment, therefore, link directly to the educational program of Herbert Hoover.

Material Handling EQUIPMENT

6-1-24

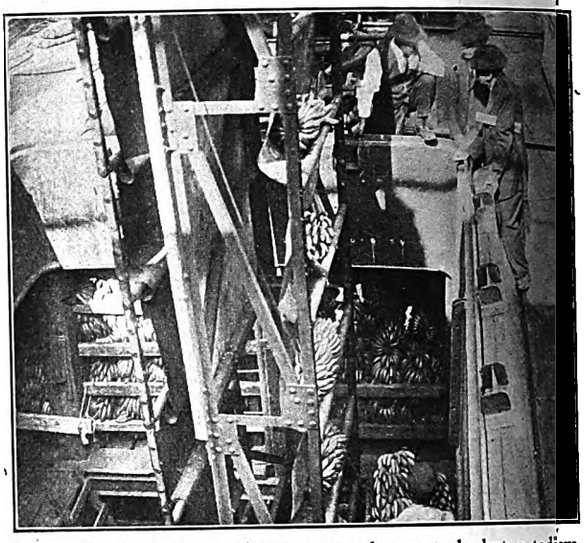
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(*Continued from page* 53)

is capable of delivering coal to the ship's bunkers at the rate of 250 tons per hour.

Foundries are users of iron and steel made from ore which has been previously handled by some form of materials handling equipment, but in the foundry this same iron and steel is again handled many times by mechanical devices and in addition the sand, flasks and other necessary materials in foundry operation are also handled in a like manner. Fig. 4 shows overhead traveling cranes for handling heavy molds, castings, etc., about the foundry floor and in the foreground is a gasoline



The unloading of bananas is not a heavy task, but a tedious and expensive one if hand labor is used.

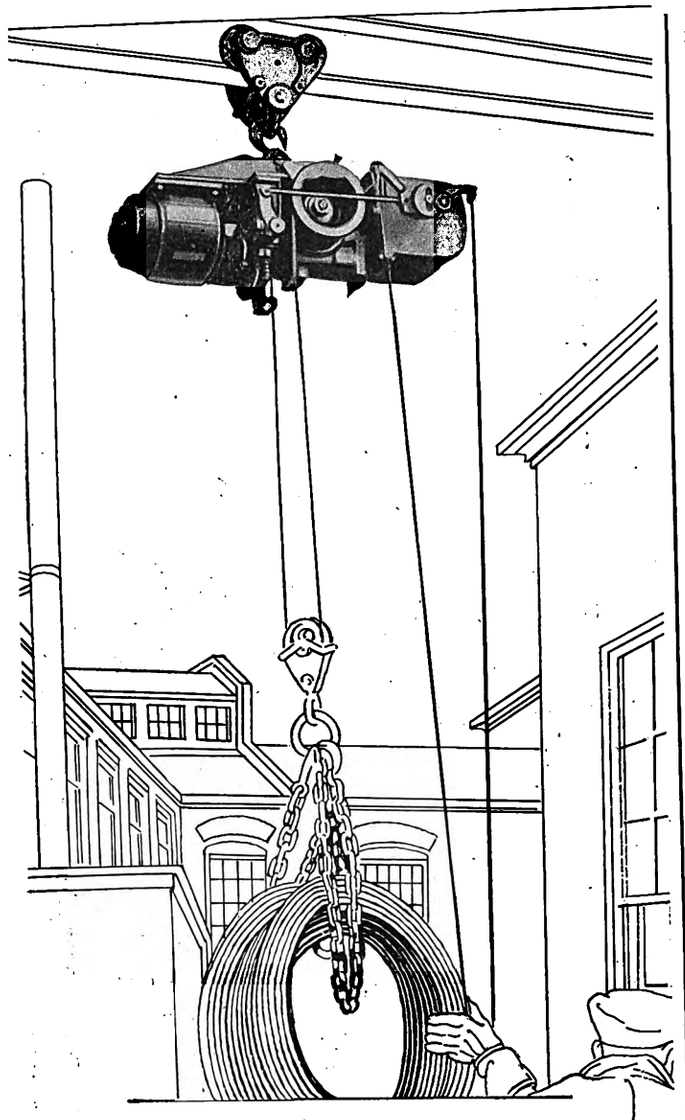
driven dump body truck, discharging sand adjacent to the molders' bins. Thus we see that again materials handling equipment affects the cost of manufactured products.

To carry this same thought a step further, we will look at Fig. 5, where machine parts are being handled. These parts have undoubtedly been cast in a modern foundry but they are still continuing to be transported by means of conveyors and elevators. In this one illustration three types of this equipment are visible; to the right the castings are being elevated by means of an inclined slat conveyor and are discharged to a short run of roller gravity conveyor, from which they are fed to a horizontal wood platform conveyor, which carries them approximately the full distance of the machine shop. Before these parts are finally assembled into a complete machine they are handled many times.

In sheet metal stamping works it is necessary to immediately carry the finished product away from the presses and for this purpose a belt conveyor, as shown in Fig. 9, has been found very economical. In order to employ this method, however, it is necessary to have the presses properly placed and many old shops are thus handicapped. New shops are now giving consideration to the handling of materials and we find that the presses are being located in reference to the conveyor and the best methods of quick transportation for finished products. The use of such a conveyor not only reduces handling cost but it speeds up production and permits a centralized inspection department and eliminates the necessity of truckers and sorters working about the production machinery.

In plants where quantity production is the rule and

(*Continued on page* 59)



Its safety stops

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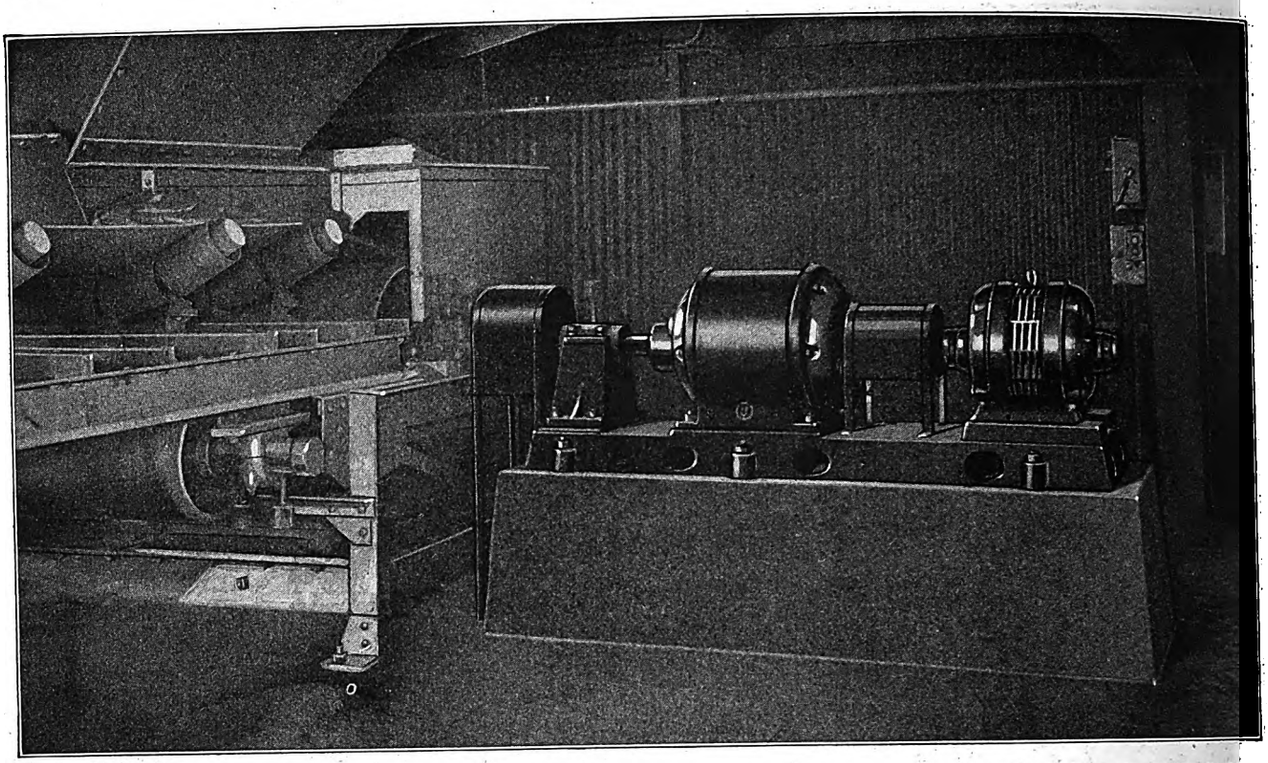
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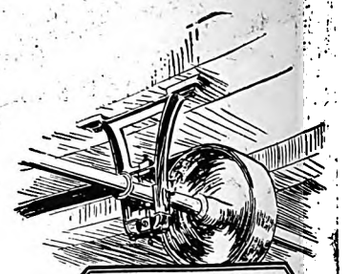
Jones Speed Reducer driving Coal Feeders in By-Products Coke Plant. Motor speed 1160 R. P. M. Final speed 35.1 R. P. M.—ratio 33 to 1.

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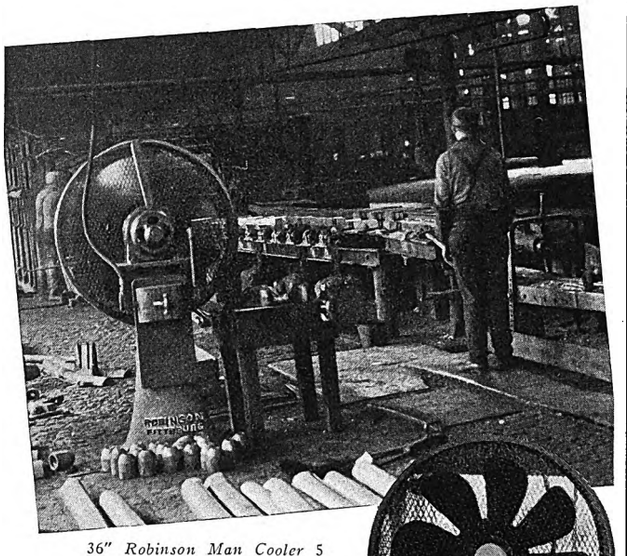
(*Continued from page* 56)

where parts are assembled into complete machines, we find different types of lift trucks assisting in the transportation of materials from one operation to another. Fig. 13 shows a gasoline driven lift truck handling a load of small machine parts in a machine shop, while Fig. 11 shows an electric lift truck handling complete motors. It will also be noted that in the handling of the motors from truck to inspection bench, a jib crane attached to the building column and equipped with a small electric hoist suspended from a travelling trolley is used. This eliminates the necessity of additional men on this operation and the truck driver can also unload the truck.

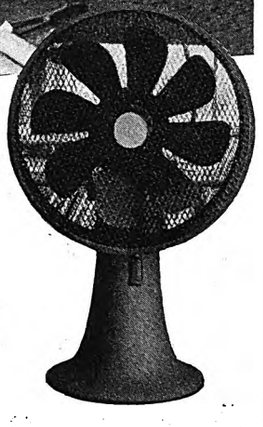
Chemical plants have long resisted the use of materials handling equipment because of the effect of acids and chemicals on the moving parts and steel work, but today they have found that the savings which can be effected are so enormous that it pays to install this equipment even though the conditions are such that it is necessary to replace the entire installation within one or two years. Equipment such as shown in Fig. 16, however, can be protected by acid-proof paint and thus operate on the handling of chemicals for years, especially on the piling of raw materials and finished products in the plant warehouse. Mono-rail systems, as shown in Fig. 7, can also be used about the chemical plant yard and within the plant and we now find that a number of process buildings are equipped with a crane bay to permit the handling of materials between floors by means of overhead cranes; in fact, in the chemical industry all types of equipment have their proper application and with proper attention and maintenance this equipment will frequently outlast more expensive process machinery.

The warehouse industry has long been satisfied to employ the same methods which have been in vogue for generations but today the industrial executive and the buying public are demanding cheaper warehousing and upon investigation it has been found that the greatest item of expense, especially in distributing warehouses is the handling charges. Many warehousemen who have not separated the item of handling from the item of storage in determining their charges to customers have been losing money without knowing the reason why. At the present time, Warehousemen's Associations and Chambers of Commerce are investigating the field of materials handling equipment in this industry and many of the new municipal owned warehouses, such as are located at the Port of Seattle and the Port of Houston, Texas, are well equipped with materials handling machinery. Fig. 16 shows a portable elevator operating in the warehouse of a chemical plant, but these same devices are also being employed in public warehouses. Overhead cranes, such as shown in Fig. 12, are also being worked into the new types of warehouses and an ideal combination is to build two-building units, as shown, placing the railroad tracks on the ground floor and the overhead crane at the top of the building, enclosing this space in glass so as to permit efficient light. At the different floor levels will be seen balconies for unloading from the cranes to the various floors.

The paper industry has been very progressive in the use of certain types of cranes, lift trucks, and other handling machinery and the reason for this is the unwieldy nature of the finished product. The handling



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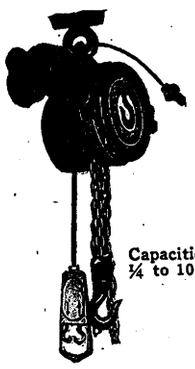
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of roll papers, as shown in Fig. 14, by hand methods, would be difficult and if the ceiling was not utilized for transportation the every movement of the finished product would seriously delay production operations.

It is a peculiar thing that all industry is dependent upon the proper handling of materials, and yet it is necessary to continually point out why more extensive use of mechanical means of handling should be employed. Each step in production is tied together by transportation, and not only is materials handling equipment necessary to production but it is also an essential part of the central power station which develops the necessary electric current to drive industrial machinery. Fig. 17 shows the exterior view of a central power plant and the buildings visible contain elevators, crushers, conveyors, etc., for preparing the coal, which is unloaded from railroad cars by means of skip hoists and locomotive cranes. In the handling of coal from mines to the ash pile all forms of materials handling equipment are used. It might therefore be said that cheap steam power is dependent in a large measure on the economical handling of coal and it will be agreed that mechanical elevators, conveyors and equipment as shown will do much to reduce handling costs.

Even during the building of industrial plants and other enterprises the use of some form of materials handling equipment, such as derricks, cranes, belt conveyors, elevators, etc., is essential. On every large construction project, and even on some of the smaller ones, many installations of this equipment are reducing the cost of building.

It would seem that the evidence presented in this one article alone should be sufficient to cause industrial executives to immediately start a complete investigation of their handling problems, but for some unknown reason they are still slow in grasping this opportunity of benefiting their own industrial enterprise as well as those dependent upon their production. Experience has taught the writer that this is not always the fault of the plant engineer, plant manager, or even the executives higher up, but it is due to the lack of knowledge and the proper appreciation of the subject by the board of directors, who must pass on appropriations for plant improvements. It is therefore necessary to educate Industrial America not only from the bottom up but from the top down on the subject of materials handling. The unskilled laboring man in the shop at one time resisted the installation of any form of materials handling machinery, but today this same class of labor is rebelling and frequently refuses to work unless it is assisted by mechanical devices. The laboring man now realizes that materials handling equipment is not "Labor-Saving" but "Labor-Assisting" and "Labor-Promoting" and in many cases the management of various industries have been told by their laboring men where to place such equipment.

It is frequently difficult to obtain increased capital from banks for industrial enterprises or even through the sale of stocks and bonds and for this reason industrial executives should consider the installation of materials handling as a source of increased capital for their business. The writer at one time, and within the space of a year, made the enormous saving of $150,000 in labor-cost alone for one company by installing materials handling equipment and this saving was over and above

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CLEVELAND HAND OR ELECTRIC TRAMRAIL

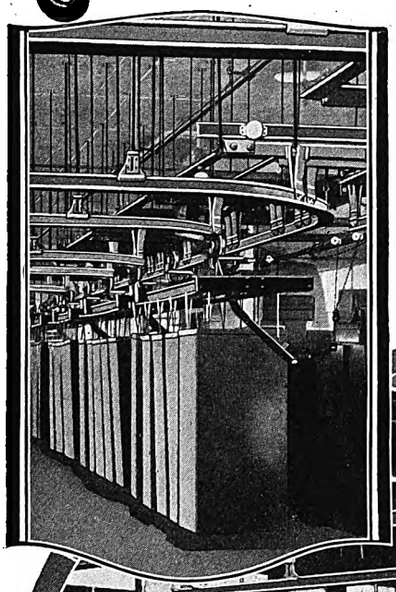
Reduce Freight Rates *in* Your Plant

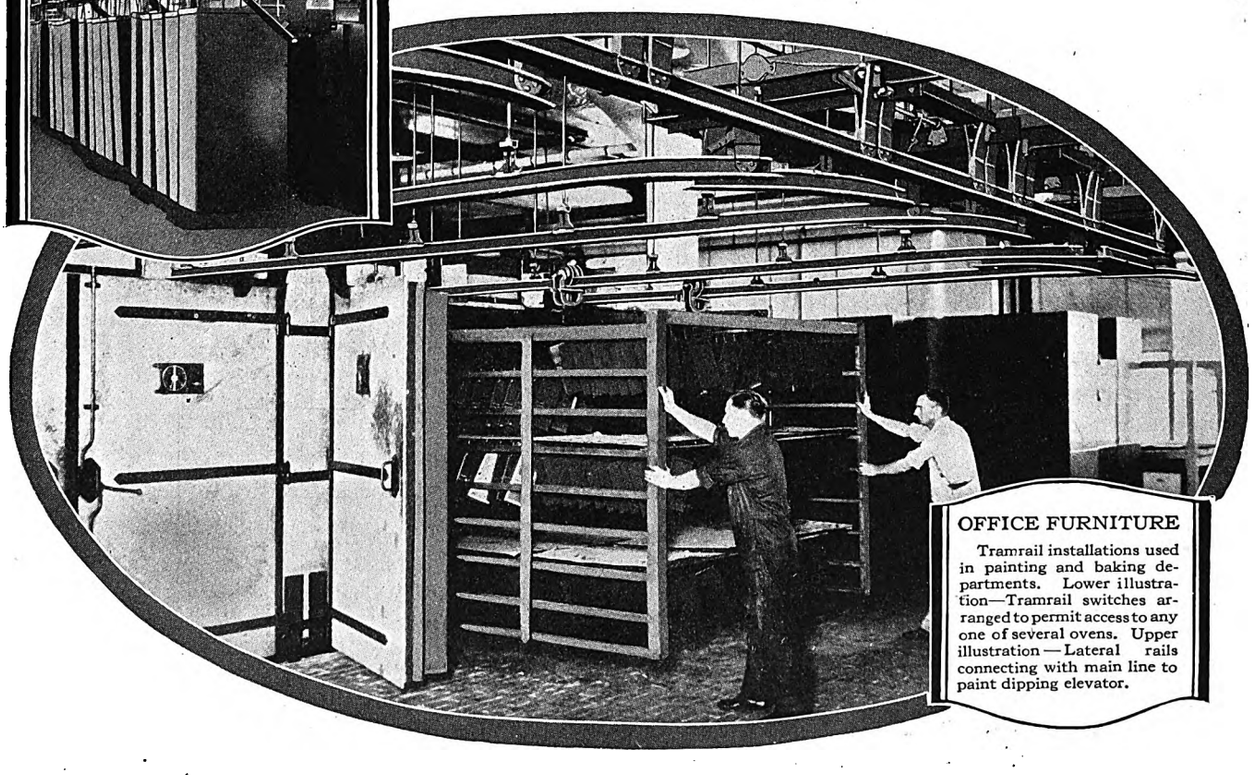
Many manufacturers complain of excessive freight rates on raw materials and finished goods, both of which hold up the selling prices of their products. Few seem to have considered the effect that high *inside* transportation charges have on production costs.

Reduce freight rates in your own plant by avoiding wasteful and expensive hand methods. The Cleveland Electric Tramrail has been designed to cut intra-plant freight costs to rock bottom.

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Tramrail installations used in painting and baking departments. Lower illustration—Tramrail switches arranged to permit access to any one of several ovens. Upper illustration—Lateral rails connecting with main line to paint dipping elevator.

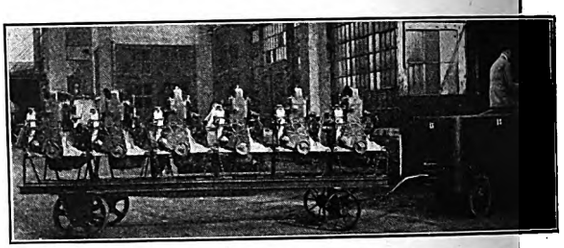
CLEVELAND ELECTRIC TRAMRAIL
DIVISION OF
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO.

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(*Continued from page 60*)

the cost of equipment, its installation, and expenses incurred in investigating. We must stop to realize that $150,000 is equal to 6% interest on $2,500,000 borrowed for one year or we can figure that this equipment would save approximately a half a million dollars ($500,000) in three years, which could be re-invested in the business. There is an old saying "That money saved is money earned," and we all know that the easiest place to borrow money is from one's own bank account and while this applies to individuals it also applies to industrial enterprises; it is for this reason that large surpluses are accumulated and held in reserve.

Industry as known in this country could not operate and mass production would be impossible without the use of mechanical power, and as previously stated materials handling equipment is one of the biggest factors of mechanical power. Industry is therefore indebted to materials handling to an extent that would be hard to estimate and this indebtedness is accumulating as more and better devices are being developed to assist and



Tractors and trailers, both large and small, play an important part in intra-plant transportation.

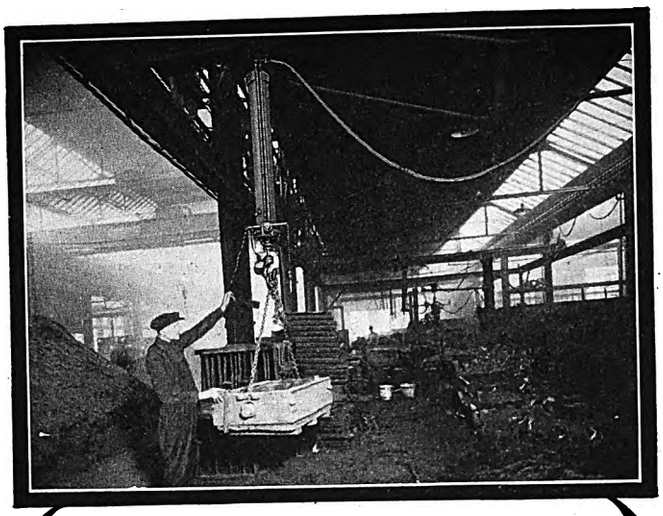
facilitate the proper coördination of other mechanical production machinery.

The subject of materials handling is now gaining momentum and more Engineers, Industrial Associations, Chambers of Commerce and Executives are becoming conversant with the various types and makes of this class of equipment. Formerly it was a subject which could only be spoken of in a general way, but today it can be spoken of in a specific manner because there are few industries in which some of this equipment is not employed. This does not mean that all plants are equipped, for there are still executives who need educating.

Industry owes a big debt to the persistent and consistent efforts of the materials handling manufacturers, who have for years patiently and thoroughly, at their own expense, placed before the industrial executives one of the greatest factors in the economical scheme of industrial management.

Editorial Credit Notice

IN the article entitled, "The Pneumatic Conveying of Materials," published in the January, 1924, issue of INDUSTRY ILLUSTRATED, we failed to give credit to Mr. E. G. Phillips, from whose book "Pneumatic Conveying," published by Sir Isaac Pitman & Sons, Ltd., of London, a number of important extracts were made. Mr. Phillips is an authority on this subject, and we regret the oversight which unintentionally deprived him of the credit for his work.



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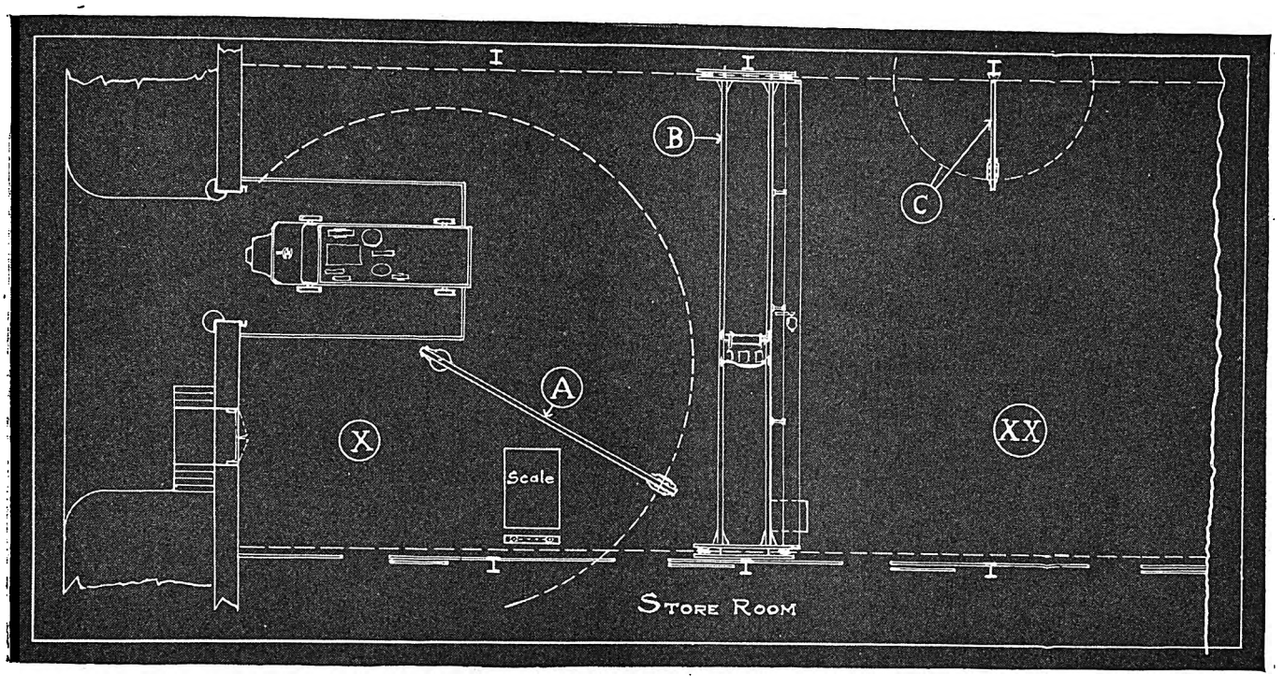
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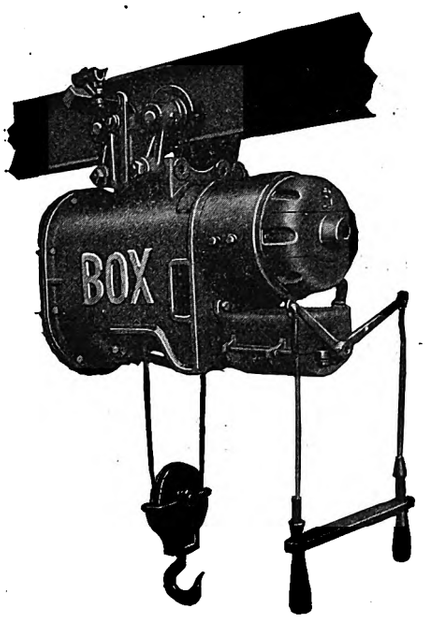
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B. BOX "B" Electric Traveling Crane used to lift and carry material from all parts of erecting floor to machines and shipping platform.

C. BOX Bracket Jib Cranes perform a quick lifting service of parts to and from machines. "Load Lifter" equipped.

X. Shipping platform. XX. Erecting floor.

The smaller Cranes with "Load Lifters" wrote their entire cost off in a short time by the saving in the cost of power which the Heavy Duty Crane would have used in doing the tasks which were "Load Lifter" work. In addition the Heavy Crane was released for more important work. Again there was no work tied up—waiting for the big Crane.

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Systemizing Motor Production at Schenectady

(*Continued from page* 23)

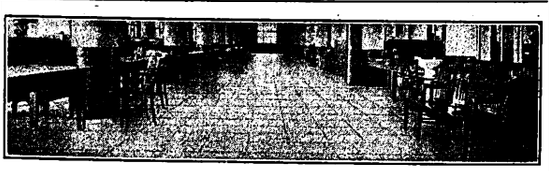
termed a "flow" of standard component parts rather than a stationary stock. While a goodly portion of the call from the commercial departments is for standard types, there are many deviations from these standards. The parts which make up the many types of motors, however, are common to 90% of the various processes of motor manufacture.

In order, therefore, to provide for the continual call for motors of both standard and special types, it is necessary to establish some means of having standard parts available. The first step taken at Schenectady is to authorize the manufacture of a definite quantity of standard motors over a given period of time. In following this procedure, the available supply of given parts is never more than sufficient to make up an even quantity of standard motors with no extra semi-finished parts left over. Production proceeds uniformly and, at any given time, the individual parts which make up the finished motor are evenly advanced in the process of manufacture.

Under this arrangement, standard motors are provided for. Based on estimates furnished by the commercial department covering future orders, this quantity manufacture covers the general call for standard machines of certain definite ratings. These estimates and manufacturing authorizations are reviewed every two months. After the motor schedules are prepared covering any specific period of time, the motors themselves in each schedule are "exploded" into their component parts and "component part" schedules are prepared and furnished the factory foremen in the motor department, each foreman being furnished with a schedule covering the line of manufacture under his supervision. It is important here to note that it is always the constant endeavor of the schedule-makers to regulate the speed of production to cover the estimated requirements of the commercial department, this being done to avoid the accumulation of a non-moving stock.

Were the manufacture of motors confined to standard types, such a procedure would be comparatively simple. In the customers' orders received from week to week, however, there are both semi-standard and special types of motors called for. The motor department, therefore, prepares each week a smaller schedule covering that week's orders for semi-standard or special motors, this schedule, in turn, being exploded into its component motor parts, 90% of which are standard in type. The special parts called for are made up in the factory on special authorization and, when completed, are assembled with such standard parts as required to make up the complete motor, these standard parts being taken from the regular production schedule. The vacant spaces in this schedule made by these special withdrawals are filled by the explosion of the weekly schedule, the standard parts of which are placed on the larger schedule, merging into the regular flow of production.

In this way, a standard production is maintained and the continual flow of orders from week to week taken care of. But provision must be made for orders which require rush delivery. These "rush orders" are handled throughout on a special basis and given preference over



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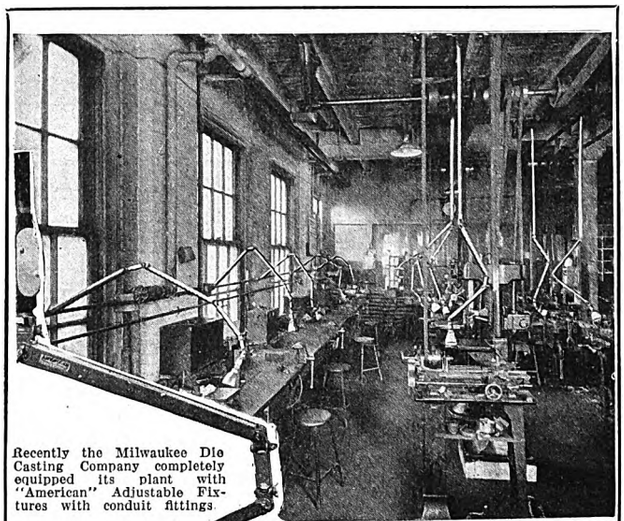
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A time and money saver



Fig. 241 screwed, Quick Opening Bronze Globe Valve, standard pattern, with lever handle. Can be furnished with hand wheel when so ordered.

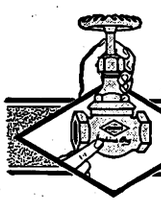
The Jenkins Quick Opening Valve saves time. It also prevents waste and saves money.

It can be opened wide in about one-quarter the time customarily required—and closed just as quickly. For this reason it is an ideal valve for all water, air, and steam lines where a quick opening is required.

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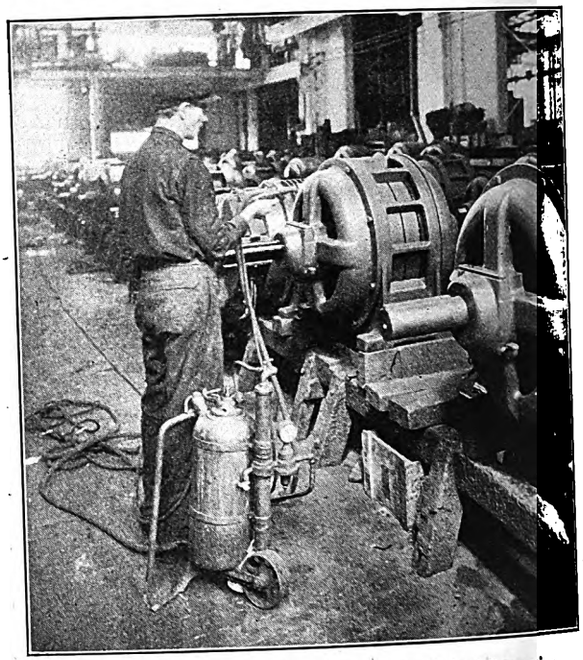
Jenkins Valves

SINCE 1864

all other production. Their standard component parts are added to the large schedule, but the parts of a motor actually shipped on a rush order are taken, if standard, from those at the point of completion. If special, those parts which are of a special nature are made up on a special basis and assembled with standard parts, always on a rush basis, for quick shipment.

In the actual manufacture of a motor, the first question to be given consideration is the obtaining of raw material. The grey iron castings used in the standard motor production are all designed for machine moulding and require very few cores. This contributes greatly to the quality of the castings, as well as economy of production, but requires large orders to realize the saving. The long range production schedules on standard parts already mentioned provide accurate information as to future requirements and permit the bunching of orders for castings, in order to secure the largest possible foundry runs without danger of overstocking.

Certain materials, such as sheet steel for punchings,



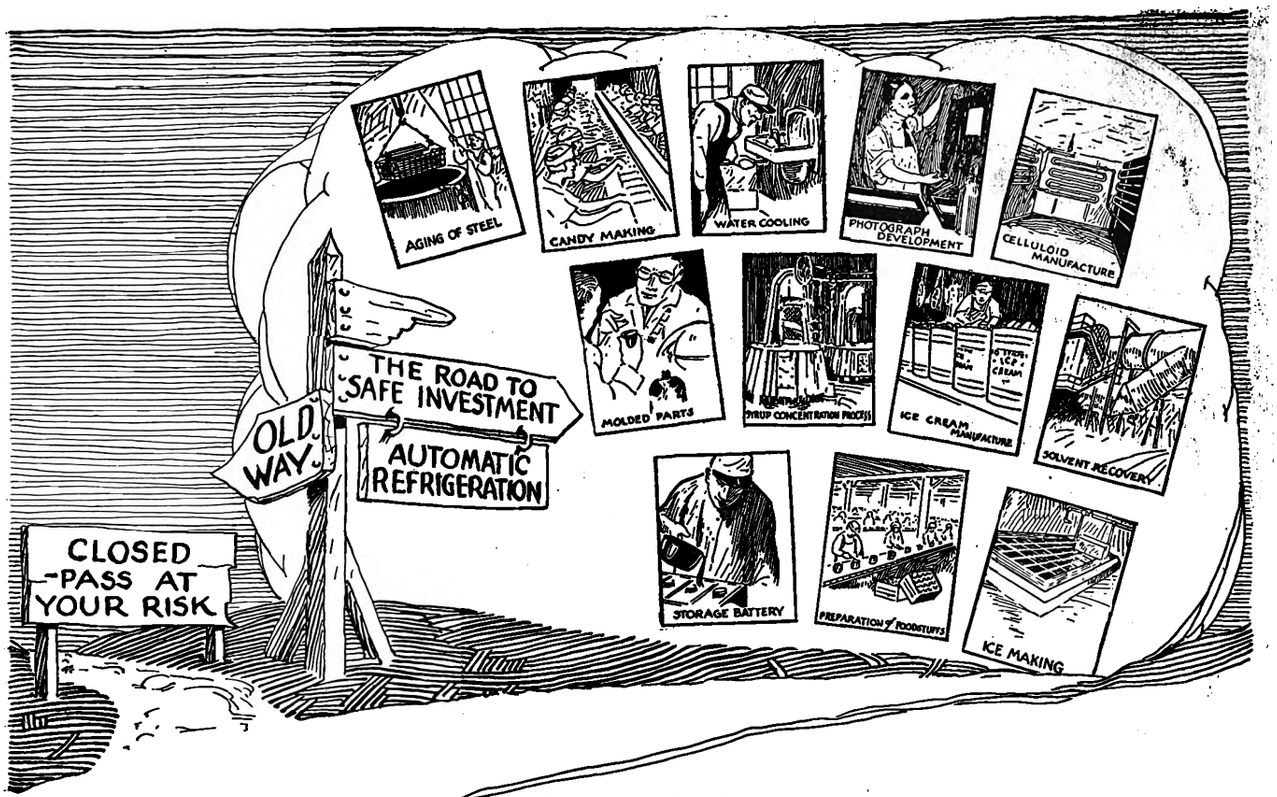
Painting motors, after they have passed final inspection.

shafting steel and, at times, copper wire, generally require so long to obtain that they must be ordered in advance of the time when production schedules are issued. To cover this, a buffer stock is set up which represents a few weeks' average consumption of each size ordinarily used. This covers the lag between the withdrawal for a given schedule and the receipt of material ordered when the schedule is issued.

In the sizes of motors made at Schenectady, all have a stator spider, or frame, of cast iron. This serves to hold the punchings, or magnetic core; to support the bearing brackets, and is provided with feet by means of which the motor is attached to its base, or foundation. The machining of this stator spider is arranged in order that these three functions may best be co-ordinated. The feet bottoms are first milled off to provide a surface for mounting the spider on the boring mill. The bore for the punching is finished to exact size and the ends rough-faced. The next operation is to broach the slots in the ribs of the spider. These slots

(*Continued on page* 68)

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New Solutions of Old Problems

Industrial executives are on the right road. They are looking forward and using every means to improve conditions and to increase production. That is why they are using Automatic Refrigeration.

Before the days of Automatic Refrigeration, steel had to be quenched under rapidly changing bath temperatures. Tanners had trouble in keeping raw hides and skins from deteriorating and bought from hand to mouth. Candy makers found that their product varied from day to day. Old-fashioned, ice-cooled drinking fountains carried contagion. Automatic Refrigeration has changed all this.

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(*Continued from page 66*)

receive the tags on the outer surface of the punchings. After this, the holes are drilled in the feet and in the ends for the bracket bolts. The spider is then ready for the assembly of the punchings.

The stator punching segments are made from a special grade of thin sheet steel. Here again quantity production is a large factor in the determining of the method of manufacture. Where the demand is large and continuous, expensive combination dies for cutting out the slots as well as the outline of the segments can be mounted on presses equipped with automatic feed. Where the demand is light or irregular, however, the punchings are blanked and later notched on indexing presses, at a greater labor cost per unit but less die cost.

After the segments are punched, they are placed in annealing ovens for several hours and then coated with enamel, this serving to insulate between adjacent layers of the core. The punchings are then ready to be stacked in the stator spider. This stacking is a hand operation, done by girls on the smaller sizes. The core is then subjected to heavy lateral pressure with a simultaneous expanding force holding the punchings back against the ribs. They are then secured in this position by keying the clamping flanges in place.

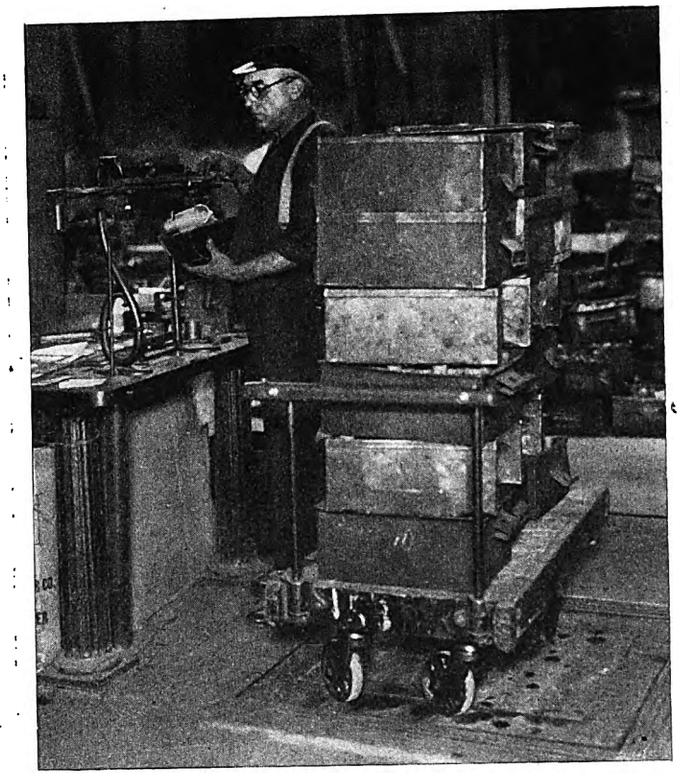
The assembled core is then placed on a mandrel and the ends of the spider accurately faced and recessed for the bearing bracket flanges, after which it is ready to receive the coils.

The operations up to this point do not differ greatly from those encountered in the general run of machine shop work. In the making of the coils and the installing of windings in the cores, work of an entirely different character is encountered. Lathes, milling machines, punch presses and practically every tool needed can be purchased from machine tool builders to perform the machining operations, but there is practically no machinery which can be bought on the market to help in making the windings of a motor. Nearly every tool and labor-saving device used in this part of the work is home-made and progress in new developments along these lines is necessarily slow. The past fifteen years, however, have shown marked improvement both in lower costs and better quality of product achieved by the introduction of new devices for making coils.

Except in the case of coils for the smallest motors using round wire in random formation in the slots, the great majority of the coils are made of rectangular shaped double cotton covered wire. The use of this rectangular wire tends very greatly to increase the variety of sizes over that found necessary with round wire, and this adds to the difficulty in maintaining proper stocks of wire. The economy in slot space and improvement in the motor, however, fully justify this increased complication.

The wire is first wound by boys into a flat coil of the required number of turns, the ends cut to length and wires tied by hand with cord in several places to hold the coil in shape until it can be moulded. Next, in a combined steam and electrically heated mould, the wires in that portion of the coil which fits into the slot are cemented together and, with great pressure and high temperature, are brought to exact size and then chilled before being removed from the mould. The pulling machine then forms the coil into the six-sided shape neces-

(*Continued on page 72*)



You could pave a line around the world with the parts this machine has counted!!

FOR 17 years the dormant type National Counting and Weighing Machine pictured above has been, together with another machine purchased a year later, in constant daily use in the Detroit Lubricator Co.'s plant. At last accounts both these machines were performing with undiminished accuracy, equalling that of more improved models that were installed at later dates.

The machine is shown counting heavy brass castings in tote pans—handling truck loads of from 18 to 24 pans in one operation.

National Counting and Weighing Machines not only save heavily in time and labor on counting operations but their long life often makes the fixing of a yearly depreciation charge-off decidedly more a figure than a fact.

National Counting and Weighing Machines are made in Counter, Portable Platform and Dormant Models. They Count—they Weigh—they Measure lineal or square measure contents. A complete description of various models will be mailed on request.

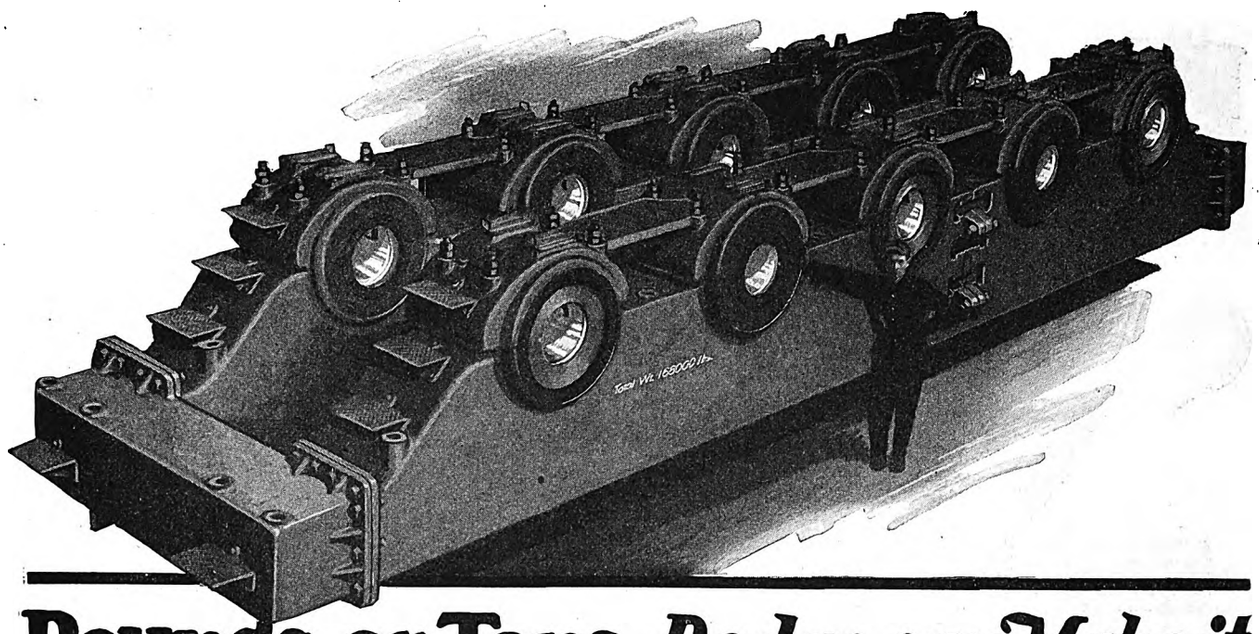
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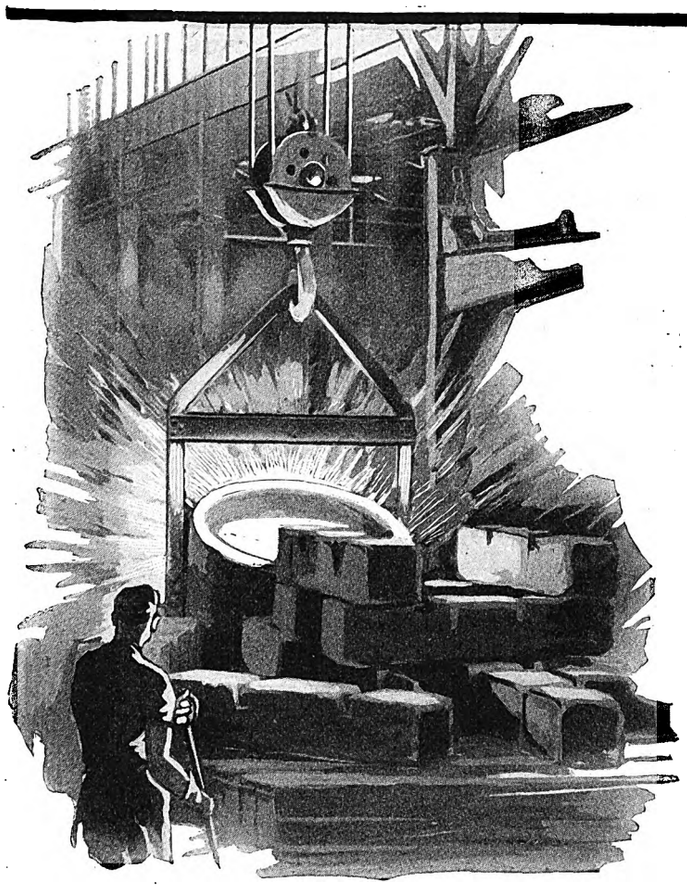
NATIONAL COUNTING AND WEIGHING MACHINES, NATIONAL CALLING SYSTEM, NATIONAL "ADJUSTABLE" STEEL SHELVING, NATIONAL "ROCKER-LIFT" ELEVATING AND SCALE-ELEVATING TRUCKS.

NATIONAL COUNTING AND WEIGHING MACHINES

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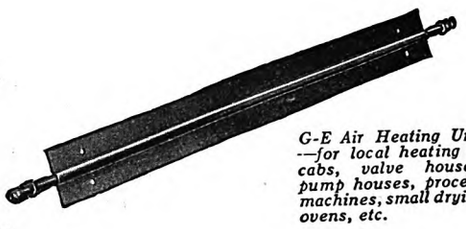
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G-E Compound Melting Pot—melts battery compound, sealing wax and like materials.



G-E Self-Regulating Solder Pot insures economy and convenience in melting solder.



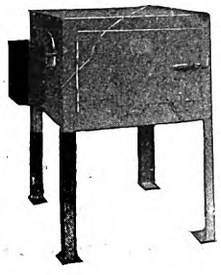
G-E Air Heating Unit —for local heating in cabs, valve houses, pump houses, process machines, small drying ovens, etc.

Heat At Its Best

It is widely used in in-



G-E Soldering Iron is recommended for continuous light soldering and intermittent moderately heavy work.

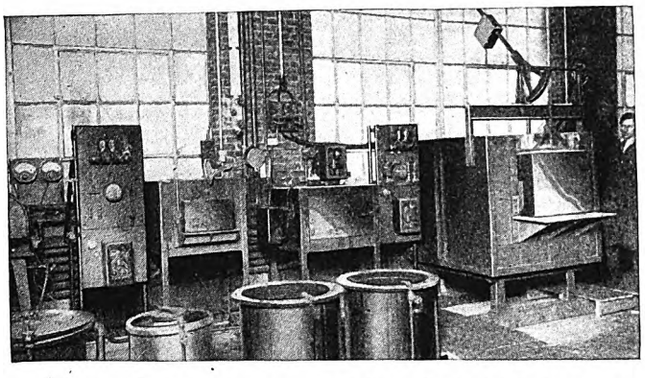


Carbon steel tools, parts and hardware drawn in the G-E Air Tempering Oven, come out clean; the temper is uniform, and the surface color of the right shade.

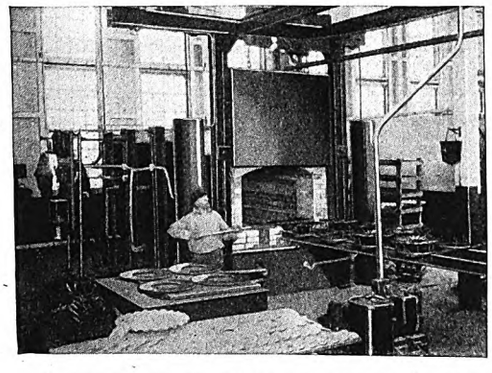
Electric Heat—quick, clean, safe, flexible, economical! Its advantages over other methods have so extended its use and development that it embraces applications that are vital in the heating processes of all kinds of industry.

It is readily adaptable to working conditions—can be used in any atmosphere—can be produced in just the exact amount and at the desired temperature. It is subject to accurate control both as to temperature, quantity, and distribution—which specific conditions can be duplicated at will.

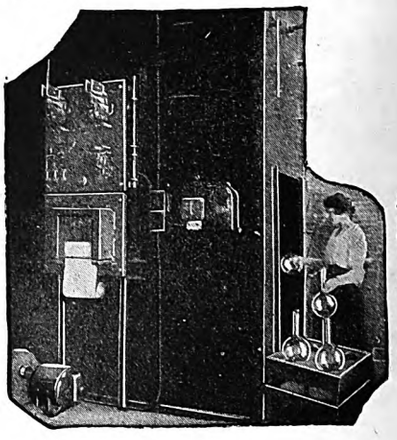
The General Electric Company builds heating units that are easily installed in the little box oven or the immense conveyor type ovens and furnaces. The G-E Direct-Heat Units with non-oxidizing ribbons are 100 per cent efficient in converting electric energy into heat that speeds production and reduces spoilage.



Installation in a heat treating shop of Direct-Heat Electric Furnaces manufactured by the General Electric Company.



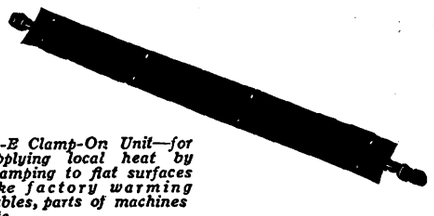
Electric vitreous enamel furnace equipped with G-E Direct-Heat Units and Automatic Temperature Control.



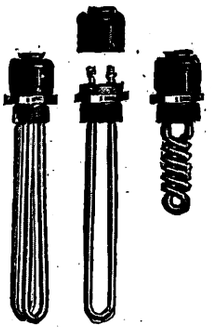
Electrically-heated glass annealing lehr equipped with G-E Direct-Heat Units and Automatic Temperature Control. The electric lehr gives just the right time-temperature cycle, and practically eliminates rejects.

GENERAL

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G-E Clamp-On Unit—for applying local heat by clamping to flat surfaces like factory warming tables, parts of machines etc.



G-E Immersion Heaters make the most reliable installations for electrically heating water and oils in industrial processes



G-E Jacketed Glue Pot effects big saving where glue is used only at intervals.

Is Electric Heat

dustrial heating processes

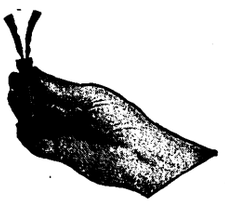
These units are compact, easily installed, and their flexibility makes possible the most desirable location of each individual heater. By combination of these units all requirements can be met for the utilization of heat over a wide and varying range in ovens and furnaces.

The General Electric Company also manufactures small industrial electric heating devices for handy use about the plant—giving to industry the broad use of electricity for practically every heating purpose. It is the originator of "Helicoil" Sheath Wire which has made possible the development of many of these devices.

Industrial Heating Specialists of the General Electric Company are ready to serve you in making recommendations covering the installations of electric heating equipment for many heating processes in your plant.



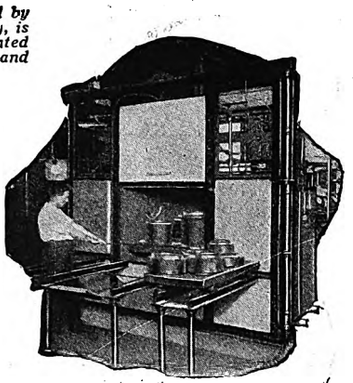
G-E Jacketless Glue Pot saves where glue is used continuously during the day. Maintains just the right temperature without attention.



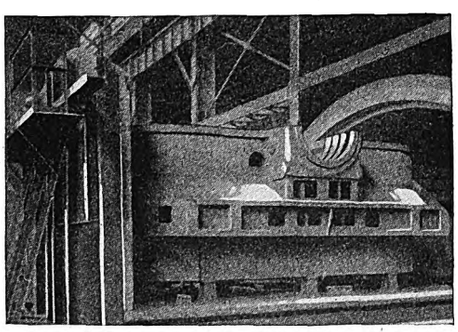
Cartridge Unit, originated by General Electric Company, is unexcelled for concentrated local heating of tools and machine parts.



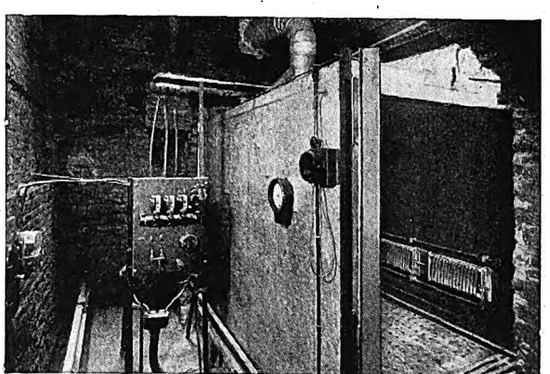
G-E Oil Tempering Bath—compact, self-contained electrically heated device for tempering carbon steels.



Baking, drying, and other oven processes are improved by the utilization of electric heat. G-E heating equipment with automatic control is used most extensively in this field.



Annealing 50-ton turbine casting in electric furnace 27 ft. long by 16 ft. wide by 9 ft. high equipped with G-E Heating Units and Automatic Temperature Control.



G-E Direct-Heat Units installed in electric oven. These units eliminate muffles and their maintenance.

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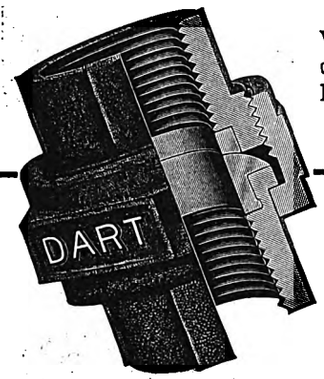
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There's no union like the Dart for your pipe lines; they require no packing, are adapted to high or low pressure and are made in all styles and sizes.



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(*Continued from page* 68)

sary to fit into the slots without further deformation. The coil is now ready for the insulation. Girls apply this both in the form of varnished cambric cloth wrappings and in the form of tapings of untreated linen tape, later filled with varnish. Many coats of insulating varnish are required to build up the film necessary to withstand the high potential tests later given. Each coat or dipping is followed by eight to ten hours' baking in an oven heated to 100° C.

The coils are then ready for assembly in the stator core. This is done entirely by hand. They require great care in handling, as any bad scratches or breaks in the insulation will cause punctures in the weakened spots when the over-voltage tests are later applied. After all the coils are finally in place and wedges driven to hold them fast, they are connected together in the proper pole and phase groups. This work requires a great deal of experience in order to avoid mistakes.

The wound stator is now ready for final assembly.

The story of the construction of the wound rotor is much the same as that of the stator, with the exception of the shafts, which are made on lathes and finished on wet grinders to very exact diameters. The squirrel cage type of rotor is somewhat different, inasmuch as the windings are not insulated from the magnetic core. In the smaller sizes, the squirrel cage windings are made of aluminum and cast in the slots and end rings. In the larger sizes, copper bars are forced into the slots and then welded to copper end rings. The final operation on the rotor, after its core is turned true with the shaft, is to balance it. On high speed motors it has been found necessary to give the rotor a running balance at full speed.

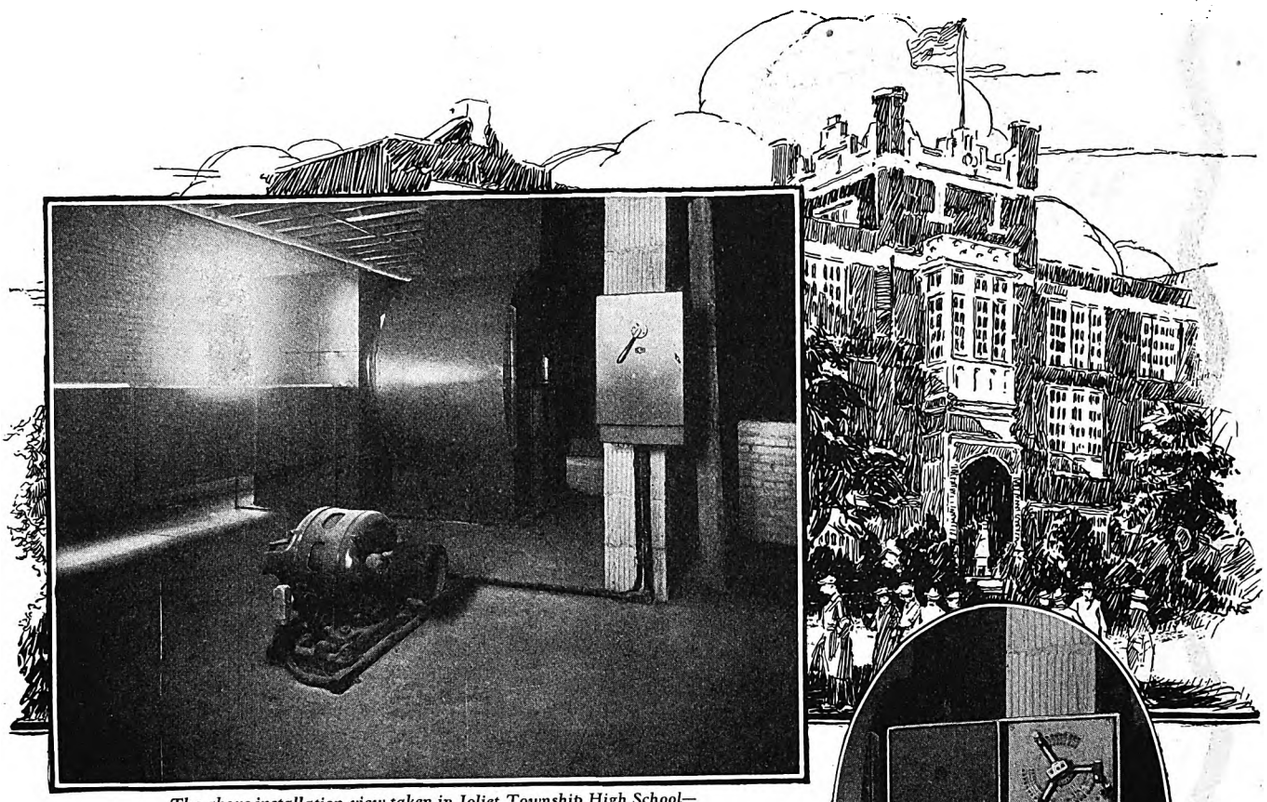
The machining of the bearing brackets of the motors below 100 horsepower can be very nicely done on semi-automatic lathes. This operation, together with drilling, covers practically all the work on these parts.

The bearings for standard motors are made in sufficient quantities to warrant quite extensive use of automatic and semi-automatic lathes and special tools and fixtures. The standard bearings are made from heavy steel tubing cut to length and each end recessed on automatic lathes, babbited in centrifugal machines, finished inside and roughed outside on semi-automatic lathes and finished ground outside by hand.

This roughly covers the manufacture of the three main parts of the standard motor. The manufacture of these parts, when completed, is so scheduled that they arrive in the assembly department at the same time. They are then assembled together and passed into test to be run and for the recording of electrical data. In the electrical test, such mechanical defects as tight bearings, end thrust due to magnetic pull, unbalance and unequal air gap are discovered, as well as any mistakes in coil connections or other winding work. Incidentally, this testing work serves as a training course for technical graduates before they take up work in engineering offices.

After the electrical test the motor is given a very careful final inspection, painted and is then sent to the shipping department to be delivered to the customer.

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The above installation view taken in Joliet Township High School—D. H. Burnham & Co., Architects

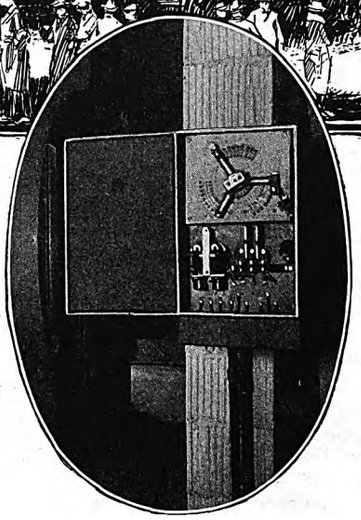
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Cutler-Hammer Building Equipment Type Controllers are particularly well suited for use with motor-driven ventilating systems and pumps installed in schools, institutions, office buildings, theaters, hospitals, and hotels.

Instead of ordering controllers for such purposes as special, the architect, engineer and contractor can now select the proper type from the standardized line developed by the C-H engineers.

These Controllers conform with the latest requirements of architects and engineers, the National Electrical Safety Code, Municipal and State Codes, and the Electric Power Club regulations.

The complete data on starting and speed regulating controllers are contained in our booklet, "Electric Control Specifications for Building Equipment."



This close-up view shows the location of starting, regulating and protective overload parts. The starting and regulating handles may be operated without opening the door of the safety enclosing cabinet.



Our booklet, "Electric Control Specifications for Building Equipment," will be forwarded to architects and engineers on request.

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BUILDING EQUIPMENT TYPE

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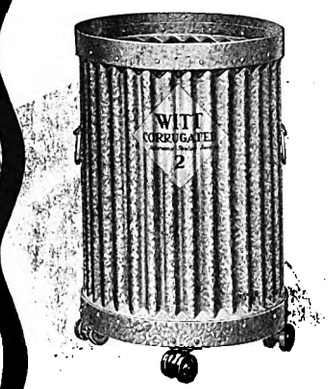
"Just a push and my 'rollers' take me from here to there in no time!"

Factories and Industrial Plants will find the new WITT Corrugated Roller Can a time and labor saver. Flexible Casters carry it quickly and easily over even or uneven floors.

The same remarkable and economical durability found in all

WITT CORRUGATED CANS — PAILS

is built into the new WITT Corrugated Roller Can. The addition of four double roller stem-type casters, held secure by cotter pins in malleable iron caster supports, riveted to the bottom band of a standard WITT Can, gives greater ease of handling. You will find by using the WITT Roller Can in the handling of liquids, small parts, etc., that your production has been speeded up and your overhead cut down.



If your mill supply house cannot supply you, write or wire us your requirements. There is a type and size of WITT for every need.

WITT CORRUGATED Substantial Sanitary Safe

The WITT CORNICE CO.
CINCINNATI, OHIO.

THE YELLOW LABEL MEANS QUALITY

Industrial Housekeeping

(*Continued from page 27*)

cause lack of cleaning often causes a shutdown of important machines.

Plant sanitation covers a great many subjects not usually associated with the word cleaning. When the policy of the organization is definitely committed to real plant sanitation and backs it up with supervision of the right kind, enormous strides can be made, and cleanliness and sanitation become a very real influence and factor in the quality as well as the quantity of the output of the plant. Usual cleaning methods are confined to what might be termed corrective methods but with a broad policy it is possible to introduce preventive methods which are apt to be more important than the other.

Sweeping is usually given very little or no consideration. It is just one of those things which must be done every so often and it doesn't make much difference how, because tomorrow or next week it will be just as dirty again anyhow. However, when a little study is given to this subject the best method for each individual plant can be worked out. There are three methods in common use. First, the gang method in which a leader and a gang of sweepers clean a department either during or after working hours. Second, the method using one or more porters in each department who constantly clean up all day long. Third, a combination of the first and second methods whereby the regular porter takes care of certain work and the gang makes periodical thorough clean-ups.

The small details such as the type of brooms and brushes used have an important influence on the cost of cleaning as well as the manner in which it is done. Rough factory floors on which there are heavy chips or other materials require stiff brooms so that they will not bend and allow the chips to remain behind. In sweeping dusty floors some sweeping compound should be used in order to keep down the dust. This is especially important if cleaning is done during working hours. There are on the market a good many compounds for this purpose but if nothing better is available sawdust, wet down with water or sprinkled with oil makes a good dust catcher. Many floors keep dusting, due to wearing of the floor itself. This is often true of improperly laid concrete floors. These floors should be hardened, painted or oiled to overcome this condition. For yard and pavement sweeping, brush brooms are usually used as this cleaning need not be so well done. Sweeping is often done by contract with the men, a price per square foot for the various departments being agreed upon after timing the work. When this method is used the care used in cleaning out-of-the-way places should be checked up, as the tendency is to get the job done quickly and as easily as possible.

Scrubbing of floors is a part of the cleaning operation that has been greatly improved with the coming of the electric floor scrubbing machine. With hand methods, stiff house brooms are usually used with a good cleaning compound that will cut the oil and grease. When done on Saturday afternoons, a good sized gang is usually used with moppers following the scrubbers. A regular schedule of scrubbing should be decided on and strictly adhered to if floors are to be maintained in good condition. Electric scrubbing and mopping machines do the

(*Continued on page 76*)

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Check the Summer Drop in Production with "Ebco" Fountains

Now is the time to prepare for the summer heat by installing "Ebco" ice cooler drinking fountains at convenient places in your plant.

"Ebco" fountains will combat the depression in the production curve when the hot sultry summer days arrive.

Choose "Ebco" fountains, because they are remarkably low in price, are well insulated, sturdy in construction and unusually conserving in ice.

Drop a line to the nearest branch representative for catalog and prices. Do it now!

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Roller Bearing Rollers
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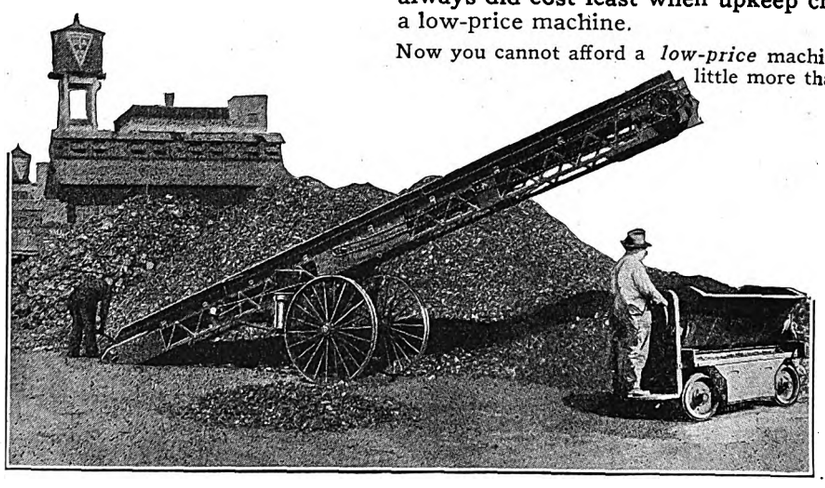
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1924 is going to be a Haiss Belt Conveyor year. We are building only Haiss quality machines, but on a quantity basis that brings costs way down. And remember first cost isn't the only thing. Haiss Conveyors always did cost least when upkeep charges were added to the cost of a low-price machine.

Now you cannot afford a *low-price* machine—a Haiss is so good and costs so little more that there's nothing to it.



Let us quote you on a 1924 Haiss Portable Belt Conveyor—or ask for Bulletin 1022.

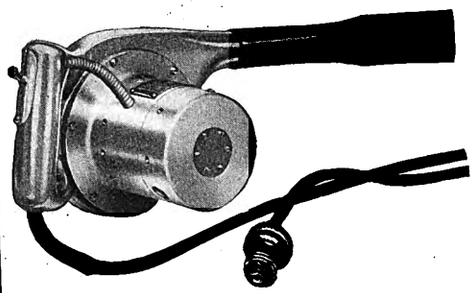
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Ball Bearing Portable Blower



6½ lb. Air Cooled BALL BEARING Motor

$40.00 Net

This "MARVEL" Portable Blower is designed for blowing dust and dirt out of MOTORS, GENERATORS, SWITCH BOARDS, LOOMS, KNITTING and other TEXTILE MACHINERY, as well for GAS BLOW PIPES, GAS FURNACES, ETC. Has 20 feet high grade cable and armored plug. Perfectly balanced. Has TOGGLE SWITCH in handle, operated by thumb. Gives 16" water column pressure.

Note the Metal Conduit carrying wires from motor to handle.

Motor operates at 10,000 R.P.M. on New Departure BALL BEARINGS. This Blower is a great time and labor saver, and its mechanical and electrical design gives assurance of a very long life, with a minimum of attention.

Made with UNIVERSAL motors (A.C. & D.C.) for both 110 volt and 220 volts. SHIPPING WEIGHT 18 lbs. Shipped on 10 days' trial, ANYWHERE.



Shipped on 10 Days Free Trial.

MANUFACTURED BY

ELECTRIC BLOWER COMPANY

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Cleaner Plant ---More Work

It's remarkable, how a clean, well-lighted, well-ventilated plant will actually increase production capacity, and better the grade of work turned out.

We can help a lot toward keeping yours *clean.* The rugged construction, the perfect balance, the extra-wide sweeping tip, and the tough bamboo core of Lay Metal Case Brooms make them ideal for general factory use.

There's a Lay Broom designed especially for your particular sweeping need.

Let us send you one for examination and trial. It's guaranteed, and we'll pay all carrying charges. What kind of a floor do you have?

The Joseph Lay Company
120 College Street
RIDGEVILLE INDIANA

"They hold their shape till worn to a stub"

(*Continued from page 74*)

work of several men at small expense and where there is a great deal of scrubbing to be done they are a good investment. These machines are great labor savers and they are bound to be used often because of the small expense and they therefore tend to bring about a cleaner plant. As a long cable is necessary to reach all parts of a room, a reel with an automatic winding device should be on each scrubber so that the cable will be kept out of the water and out of the way. The floors in the plant are usually of concrete, wood or composition. In toilet rooms they are frequently tile. This may be easily kept clean and is sanitary and vermin proof.

Oily floors require special cleaning compounds that will quickly remove the oil and grease and grime. The use of the correct compound for the individual job will usually save time and expense and it is good policy to call in experts in this line if the results are not commensurate with the time and money expended.

Vacuum cleaning has replaced sweeping in a great many plants. With a portable electric driven cleaner, no fixed piping is necessary and the cleaner may be wheeled all over the plant. Cleaning may be done during working hours without raising any dust and this fact alone is often a sufficient reason for the installation of this equipment. New plants may be piped up with outlets conveniently located and with a stationary cleaner in the basement. Such an installation is ideal. It is usual to use this system for cleaning dust from machines or equipment that could not otherwise be cleaned. Dust constitutes a serious fire hazard, which can, and should, be very greatly reduced.

Washing windows on the outside of buildings with steel sash usually necessitates some kind of staging. A small staging that may be hooked over the edge of the sash is the easiest way to handle this. The staging should be light so as to be easy to move from one window to the other and at the same time it should be strong enough to support a man. It is best to have a safety railing on the outside of the staging. Dirty windows and skylights cost money every day because it is necessary to light up earlier than would be necessary if the windows were clean. Cleaning windows therefore pays for itself. Only the south, east and west sides of a building get sunlight, the north side gets daylight which is diffused by the sky. This is excellent light as it is not necessary to draw shades and the room is lighted better farther away from the windows. With artificial lighting we usually have from five to fifteen foot-candles illumination whereas with daylight we have a great many times this intensity. The bright summer sunlight gives an intensity of about ten thousand foot-candles so it can easily be understood that daylight should be used whenever possible. The higher intensity of illumination during the day naturally allows the men to work faster and produce more so it is important that daylight be used as long as possible in order to speed up production. Insurance records indicate that more accidents occur during the winter months and when artificial lighting is in effect, so by keeping windows and skylights clean, accidents will be lowered.

Glass areas are expensive to install and they should be kept clean to make the investment profitable. A regular schedule of cleaning and a certain gang of men for this work is the only effective way of maintaining the

(*Continued on page 79*)

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What do You Waste?

NOT geographical location and climatic conditions, but the type of heating system employed, is what the Jenckes Organization found to be the controlling factor in fuel costs (see letter below).

This big textile firm did what every manufacturer and building owner should do—determined to find out what method of heating would prove most economical under the conditions peculiar to their own individual plants. They demanded specific figures—both on first cost and operating costs— on various types of heating systems.

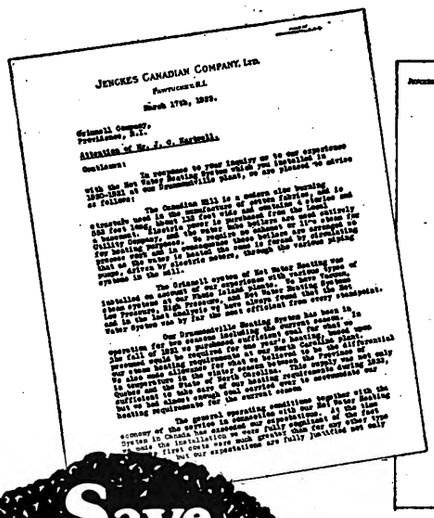
In this case a forced circulation hot water system cost more than steam. But this is not always true. Sometimes hot water systems cost less, sometimes more, to install than steam systems. But they save so much in fuel that any difference in first cost is soon returned many fold.

Yet the majority of manufacturers and building owners let contracts for heating systems without even inquiring into hot water's cost. They consequently never find out about the operating economy of such systems. The result is wasteful steam systems.

With any steam system you must spend good money for tons on tons of coal to produce extra heat *which is not needed.* Consider! The mean temperature for the winter months in five Northern cities is approximately 40°. At this temperature buildings can be heated to 68° by sending water into a properly engineered hot water system at 145° to 155°. Not more than once or twice a season must water be heated to 212°. But every day with a steam system you must raise 212°— enough to produce steam—or you get no heat.

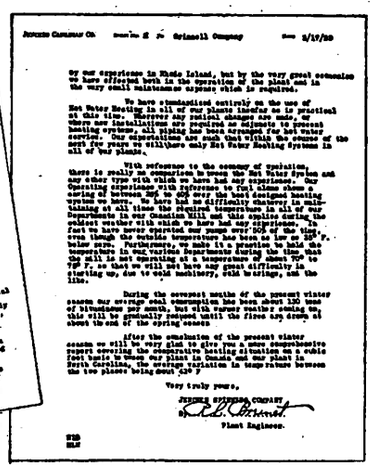
Hot water gives the right amount of heat—no more. It gives this exact heat when the outside temperature calls for it—not before or after. You don't have to feed it excess fuel to give excess heat.

How much coal does steam heat waste for you?



JENCKES CANADIAN COMPANY, Ltd.
Pawtucket, R.I.
March 17th, 1923.

Grinnell Company,
Providence, R.I.
Attention of Mr. J. G. Hartwell.
Gentlemen:



Save 20 to 50% on your coal bill.

HERE you have in general terms the advantages of hot water heating. But in the last analysis these advantages are governed by the engineering skill with which the system is planned and installed.

For more than seventy years Grinnell Company, Inc., has specialized in industrial heating and piping. Grinnell Engineers are fully equipped to cooperate with you and your consulting engineer or architect to eliminate waste from your heating costs. Our construction organization is through long experience able to translate the plans of a hot water system into a proper working equipment fully guaranteed.

If you want the truth about heating write us. Grinnell Company, Inc., 306 W. Exchange St., Providence, R. I.

Ask YOUR Architect or Engineer about the Grinnell GUARANTEE

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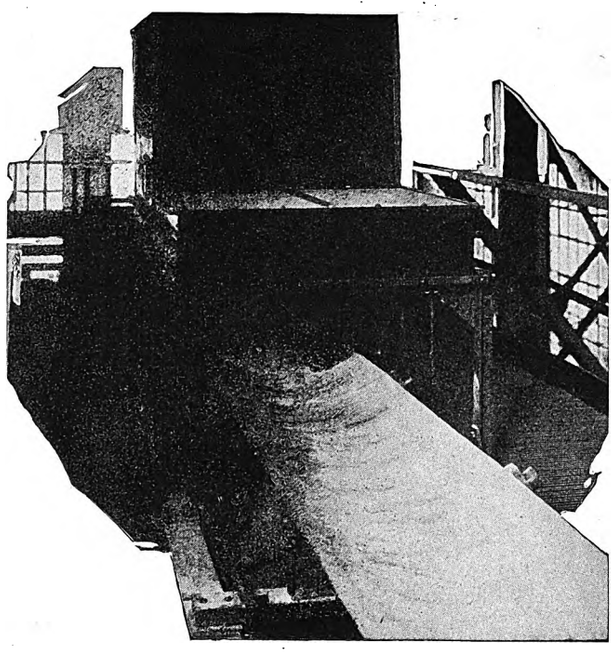
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(*Continued from page 76*)

windows and skylights in good condition. There is a certain cheerfulness about well cleaned windows that reflects on the tone of the men and makes them contented. On the other hand, dirty windows depress the men besides giving them poor light. With the window cleaning compounds now on the market it is an easy matter to clean windows compared with the older methods, and winter cleaning is now possible. The average cost of cleaning windows is from three-quarters of a cent to one cent a square foot, including material and labor. Surely no one can afford to do without clean windows. In factories where the sun beats in and there are no shades, some provision must be made to reduce the glare. There are on the market several coatings for taking care of this. This coating should keep out the glare but let in the light. It will naturally reduce the light a little but it will also diffuse it.

The lamps and reflectors of the lighting system must be regularly cleaned in order to keep the lighting up to standard. It is best to have a group of men trained in this work to take care of it all over the plant. They will soon get adept at handling this work and the cost will be reduced. The cost of cleaning the large steel reflectors and lamps averages about five cents, this cost being dependent on the frequency of cleanings and the class of work done in the department being cleaned. Even in so-called clean assembling rooms there is a great deal of dust and grime that settles on the fixtures, and in dusty departments, the accumulation on the lamps and reflectors quickly causes a large loss of electric energy. The frequency of cleanings is a matter to be individually decided but it is best to be on the safe side and clean too often rather than not often enough, because by keeping lighting up to standard, production will be kept uniform. It is possible to figure out the most economical period of cleaning any group of lighting units by taking into consideration the cost of power, cost of cleaning, the loss of light due to dirt accumulation and the number of hours per day that lights are burned. With average conditions the fixtures in a clean assembling department should be wiped out every three weeks and washed every three months. In other departments the cleaning should be more often, depending on the amount of dust and dirt in the room. In dusty and smoky places like foundries the fixtures need washing every week. For dry dirt, fixtures may be wiped with a dry cloth, then with damp one, and then dried with a dry cloth. When fixtures are washed, a good cleaning compound or soap and water should be used. If soap is used it should be thoroughly rinsed off, as dust sticks to a soapy film very quickly.

The cleanliness of toilet rooms has a very important influence on the health of the workers and it is therefore good policy to see that this work is thoroughly done. In large plants an inspector is often required to check up on the work of the cleaners. Closets are now made of all porcelain, without seats, for factory use but many object to them. However, if seats are installed they should be sanitary and waterproof. Quite a difference of opinion exists regarding the relative advantages of flush tanks or flush valves but if the pressure of the water is constant and reasonably high the flush valve is best because the workmen cannot tamper with it. Simplicity of working parts exposed to tampering is the aim of manufacturers of this kind of equipment.



Move and Weigh at the Same Time

THE Merrick Weightometer enables you to weigh materials and record the results as they are carried along on the conveyor without the flow being interrupted or retarded.

All conveyor handled materials—coal, sand, coke, stone, gravel, rock, pebbles, wood chips, can be weighed; you know how much is being received, how much is being shipped, and you can maintain an accurate check on mill operations.

The Merrick Weightometer requires no operating expense; the action is entirely automatic. Furthermore, it is guaranteed to be 99 per cent. accurate.

You can eliminate the necessity of relying upon bills of lading by having your conveyors equipped with Merrick Weightometers as hundreds of firms have done.

Ask us to send "Merrick Circulars" showing types of installations. There's no obligation.

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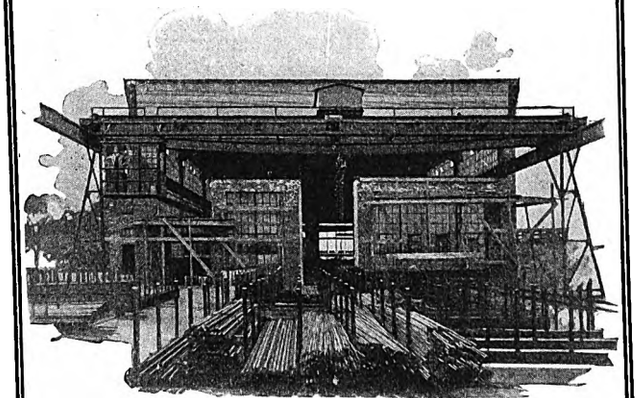
NILES CRANES

Rugged, sturdy construction of the lifting gear and electrical equipment assures the strength and reliability of Niles Cranes.

Accessible bearings are easily oiled. A thorough lubrication system reduces wear to a minimum. Cables that are prevented from twisting have long life.

Built in all standard sizes up to 250 tons capacity.

Niles Cranes include jib, gantry, wall, and electric traveling types. There's a right type and size for you, no matter what your needs.



NILES-BEMENT-POND CO.

111 BROADWAY, NEW YORK

The high stall urinal has pretty nearly rendered obsolete the old small urinal with which it was necessary to have slate or marble panels. On the high stall urinals the flush valve is most always used. Both closets and urinals should have daily cleaning with a disinfectant solution to be safe. If possible to do so, all closets should be ventilated at the rear of the fixture, but if this is not possible a ventilating stack or exhaust fan should be installed.

Partitions between toilets in the plant should be of steel or slate so that they can be washed down. They should be raised from the floor about a foot so that the floor may be easily scrubbed or washed. On account of its greater durability the steel toilet partition is gradually becoming universal and when it is enameled or painted it is very desirable from the sanitary standpoint. Glazed tiles on toilet room walls are easily cleaned with soap and water and they may be rinsed with hot water or washed with a hose. Tile floors should be scrubbed with a scouring powder and then mopped to get the accumulated dirt off the floor and then they should be rinsed with clean water, preferably hot water. This will leave tile floors clean and free from streaks.

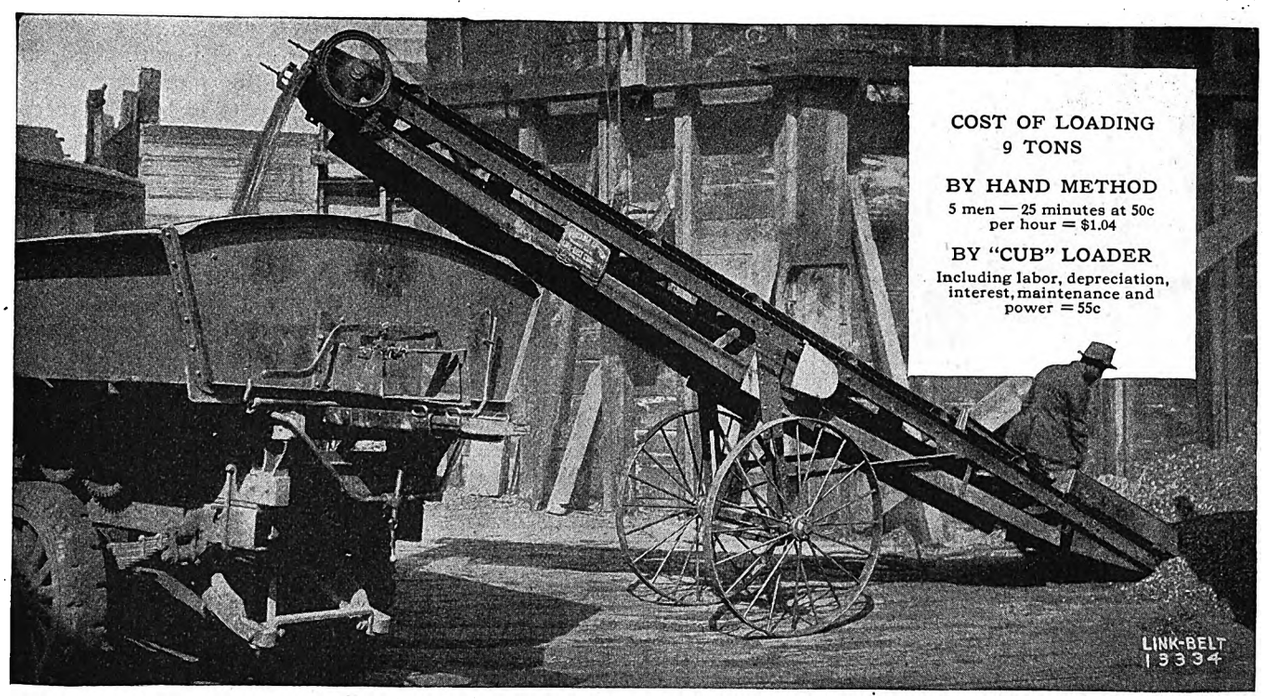
Lockers and wash bowls are usually located as near each other as possible. Individual steel lockers and individual wash bowls make an ideal installation. This is often considered too expensive but it pays in the end by making the men feel that the management is interested in their comfort and welfare and it tends to make contented workmen. Steel lockers are sanitary and prevent the spread of disease germs, they also reduce the fire risk, as many men hang oily clothes in lockers. Where there is not enough room for single lockers, double tiers may be used, but in the winter the men dislike these because their overcoats will not hang straight in them. Individual wash bowls are quite expensive to install but health regulations are more and more insistent on having workmen wash in individual bowls or in clear running water in order to prevent the spread of disease. The old long double trough sinks that were filled with water before quitting time and in which all the men washed are very unsanitary. White enameled sinks may have a double row of faucets over the middle of the sink, allowing the use of running water but it must be seen to that the drain is not plugged up. Large, round sinks wherein the clean running water is thrown upwards like a fountain are very sanitary and because the men have no control over the amount or temperature of the water they are very good. An attendant turns on the water just before the men are ready to wash. In departments where the men get very dirty or perspire freely, shower baths should be provided. These should have mixing valves for regulating the temperature of the water.

Disinfectants should be used in water closets and urinals every day. A dilute solution used for cleaning them can be made to do double duty by flushing the traps with the solution left over after cleaning. A disinfectant that is at the same time a cleanser and a deodorant will have many advantages. In order to keep a plant so that health conditions are all right it is necessary to regularly use a good disinfectant, especially in toilet rooms and in the cleaning of cuspidors.

Many plants furnish soap and paper towels in office wash rooms but do not furnish either in the shop wash-

(*Continued on page* 82)

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Link-Belt's "Cub" Portable Loader
Cuts Handling Costs Over 47%

Handling costs reduced over 47%. Equipment paid for in 6 months, and now returning 197% net every year. Why not these economies in your work?

2 Men Do the Work of 6

Where formerly five or six men were needed to handle materials in a Chicago coal yard two men now do all the work. The wages of four men saved every day. And where once it cost 13c a ton to handle these materials, it now costs 5½c a ton. You, too, might be saving 7½c on every ton of material you handle.

Loads ½ Ton a Minute

The advantages, however, are not all in labor savings. This conveyor moves one thousand pounds of material every minute—ten tons in twenty minutes. "Faster than any other loader" says the owner. The increased speed prompts orders, promotes good will, and keeps the wagons and trucks going on an even schedule.

Investment Pays 197% a Year

It is surprising how quickly the "Cub" pays for itself. This Company paid $600 for their "Cub" Conveyor (the present price is $485). In six months it had paid for itself. And ever since it has paid 197% in clear profit—actual cash pocketed each year.

Many Uses

You can use the "Cub" on a number of jobs. You can use it on foundry refuse, coal, sand, gravel, stone, fertilizer—any material that can be loaded. You can use it to load from the ground to wagons, trucks, or cars. You can use it as a short uphill conveyor.

Price $485 Complete

including 2 H.P., two or three phase, 60 cycle motor. It includes 21-ft. conveyor length. It includes a belt 18 inches wide that assures large capacity. Everything complete.

Compact, sturdy,—the "Cub" is built for hard service under the most exacting conditions.

And in Your Work

Investigate the possibilities of this low-priced conveyor for handling your materials. We will gladly give you complete information including suggested uses and detailed description of the equipment. No trouble. Simply send the coupon today —without obligation.

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LINK-BELT COMPANY

PHILADELPHIA, 2045 Hunting Park Ave. CHICAGO, 300 W. Pershing Road INDIANAPOLIS, P. O. Box 346

$485 Complete

LINK-BELT COMPANY Ind. Ill.
2045 HUNTING PARK AVE., PHILADELPHIA

We are interested in the Link-Belt "Cub" Portable Belt Conveyor at the new low price, F. O. B. Chicago or Philadelphia—$485.

Please send us full particulars. We load_____tons of_____ per day_____. From ground storage to trucks or how?_____

NAME_____ FIRM_____

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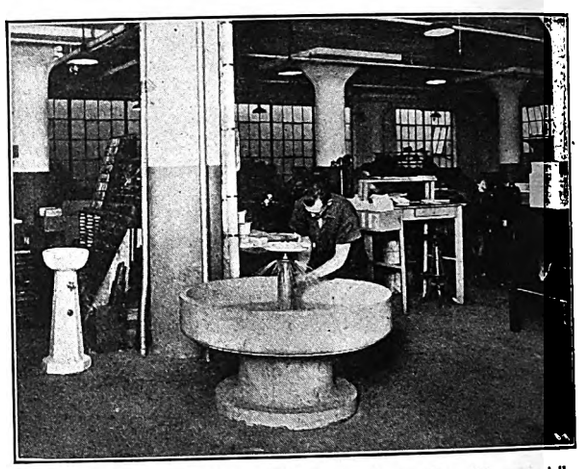
LINK-BELT

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(*Continued from page* 80)

rooms. However, with the increasing use of piped up liquid soap many plants are furnishing this out in the shop. The men naturally prefer not to have to carry soap to and from their lockers and some plants have furnished bar soap out in the shop but as a rule this has not been found satisfactory. It is very unsanitary and after a man with dirty hands gets through using a cake of soap it is not very clean-looking for the next fellow. Powdered soap has been used in office washrooms for some time but like the glass liquid soap dispensers its use is usually confined to the office. The unsanitary practice of a number of people using the same soap apparently is not realized by many people else it would not be tolerated in public washrooms. Infections are easily carried from one person's hands to another and it is a good thing that plants have furnished no soap rather than subject the men to the chance of infection.

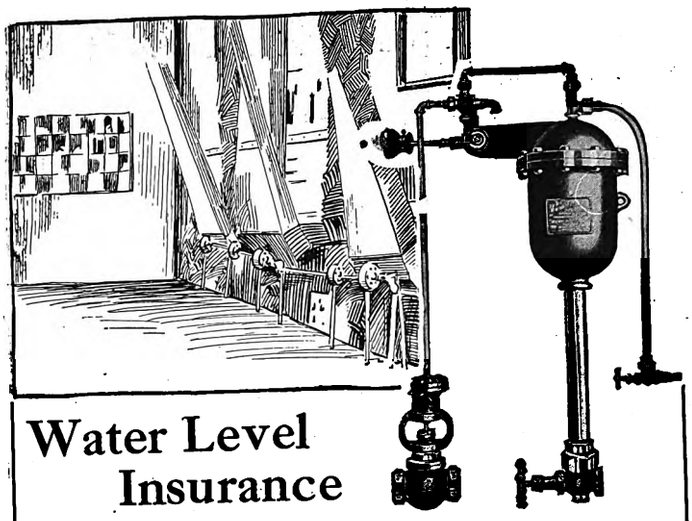


Wash fountains such as this are often adaptable, especially where space is limited.

The icing of bubblers is a job that should be well taken care of during the summer. The men should drink lots of water and if it is cold they will drink more. A truck specially built for this icing job should be lined with zinc or galvanized iron with a drain at the bottom controlled by a cock or a faucet. If city water is used it may be filtered if it is not up to standard. If the only water available is found to be not good for drinking by chemical analysis, some such method as artesian wells should be tried or else first class filters should be used.

Fireproof covered cans should be provided for rubbish such as garbage and waste paper so that the shop will be kept clean. With cans conveniently located, there is no reason for throwing rubbish around. These cans should be emptied every day; preferably after lunch. Each department that does machining work makes chips, and proper receptacles should be furnished for these. It is best to have cans or bins for each kind of chips or scrap made in each department and these should be cleaned out periodically. In cases where a large amount of chips are made on a machine in a day, such as on automatic screw machines, the chips should be removed in special trucks every day and taken to the oily chip separators or to the large bins for that particular kind of chips. Large bins may be hung on the outside of the building at about the third floor level and openings cut into the walls so that the different varieties of chips may be dumped into the bins. With hopper bottoms on these

(*Continued on page* 84)



Water Level Insurance

That's what the Vigilant Feed Water Regulator gives you—water level insurance.

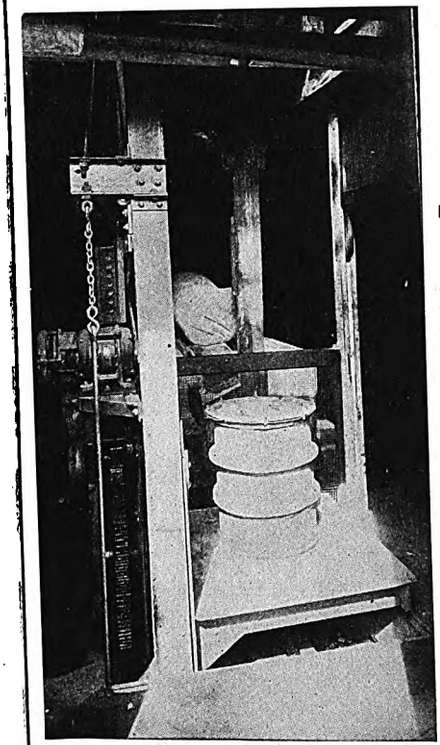
This means an *automatic* maintenance of the proper boiler feedings; the elimination of the uncertain human element; it means fuel conservation and explosion prevention.

Vigilant Feed Water Regulators operate by gravity and have no parts that can get out of order. They are absolutely dependable and reliable.

Our engineers will be glad to make a study of your conditions and requirements.

The Chaplin-Fulton Mfg. Co.

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DELTA

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Hand and Electric Portable Elevators to handle Boxes, Barrels, Crates, Bales, Etc.

Ask for catalog 105 and let us show you the time and money saving features of the DELTA.

Unit Machines for fixed position use, make easy handling to mezzanines, etc. Any capacity, platform, size or speed.

New Jersey Foundry & Machine Co.

90 West St. New York

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MERCURY'S Honor Roll

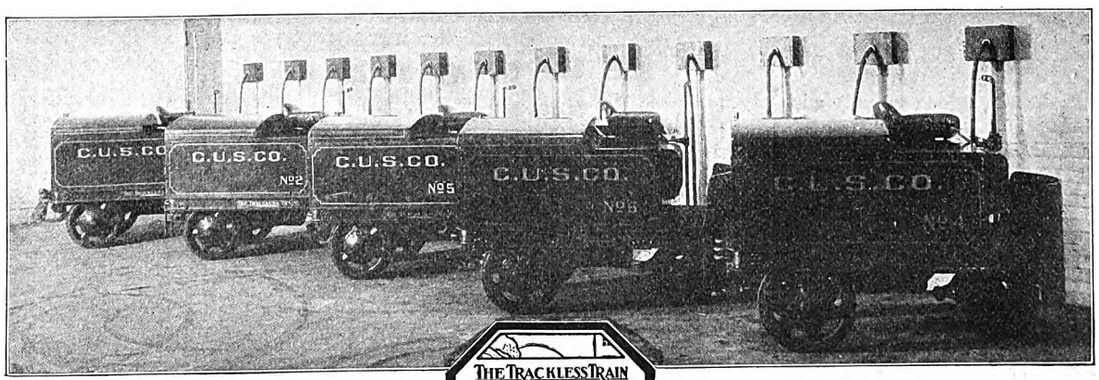
It is an honor—which we freely acknowledge—to record so many of America's industrial leaders among the big users of Mercury tractors and trailers. The Mercury Trackless Train system, through more than 8 years of use, has earned its right to an important place in the daily operation of scores of big industrial and transportation companies throughout the world. It is only on the strength of this record that Mercury equipment has been added by such companies to the extent indicated below.

Every one of the 27 users in the list owns 10 or more Mercury tractors. Two have over 100 each in operation. Eight are using 50 or more. Eighteen have bought upward of 25 machines. The number of companies owning several Mercurys, but less than 10, is too great to list here.

Morris & Co.
Armour & Co.
Studebaker Corp.
Miller Rubber Co.
Chicago Tunnel Co.
General Electric Co.
Endicott Johnson Co.
American Radiator Co.
U. S. Yds. & Transit Co.
United States Government
New York Central System
American Window Glass Co.
Sugimura Warehouse (Japan)

Swift & Co.
Lehon Company
Standard Oil Co.
Trumbell Steel Co.
Willys-Overland Co.
Kewanee Boiler Co.
Pennsylvania Rd. Co.
Sears, Roebuck & Co.
Illinois Central Railroad
American Ry. Express Co.
Chicago Union Station Co.
American Car & Foundry Co.
Eastman, Gardiner Lumber Co.
Chicago, Burlington & Quincy R. R.

It is highly significant that most of the above companies were confirmed users of Mercury tractors before the new Type H was perfected. This recently announced model with the internal gear drive offers economies of 25 to 35% in power consumption over the conventional worm driven machine. If you are not already fully informed on this important development, you will find our Bulletin No. 106 absorbing reading. Ask for a copy today.



THE TRACKLESS TRAIN

Mercury Manu[illegible]ring Company

4118 South Halsted Street — *Chicago, Illinois*

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(*Continued from page* 82)

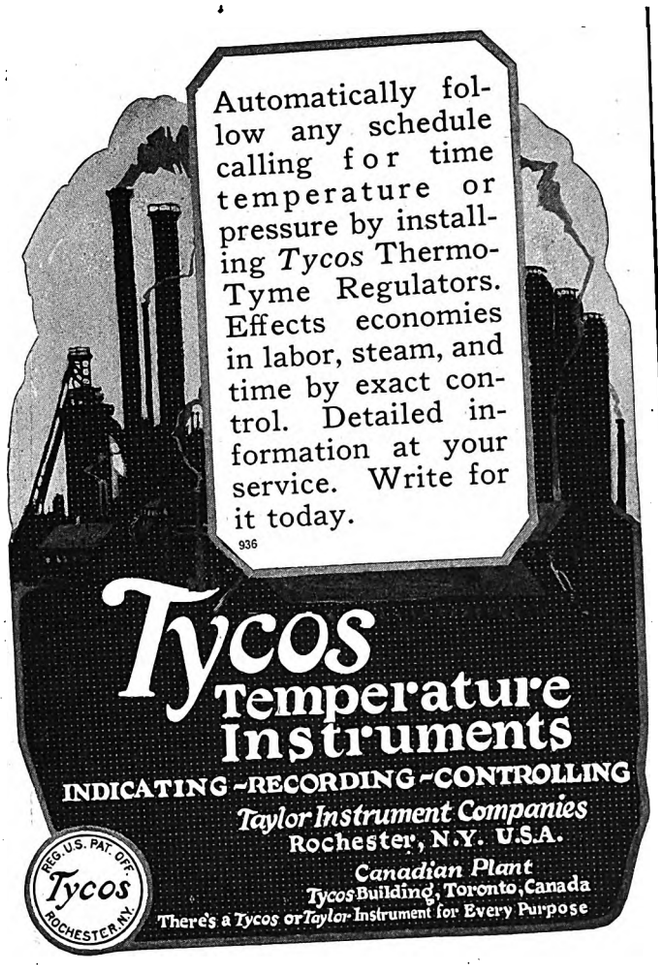
bins it is an easy matter for an auto truck to back under the chute and get a load.

Waste paper should be quickly removed to a fireproof room for sorting and baling, or it should be removed from the plant every day as rubbish. With a baler it is usually possible to get quite a little more for the paper than the cost of the labor of baling, as this can be done by regular porters in spare time unless there is enough to keep a man or two busy. For any large quantities of paper, a motor driven steel baler is a good investment and is fireproof.

For cleaning oil off of machined parts the newer types of metal washing machines are superseding the old soda kettles where a man dipped a basketful of work up and down until it was clean. The larger machines have capacities of many tons of parts in a day and are a paying investment, as they need only attendants to feed work in and take it away after it has been cleaned.

Collections of oily chips should be made every day. Special trucks are a great help in this work and arrangements should be made so that the men can dump the truckload of oily chips directly into bins above the oil separators. On machines making quantities of oily chips, removable splash guards should be installed front and back to keep the floor clean. The machines usually have drip pans to catch the oily chips. Centrifugal oil separators are used for getting the oil out of the chips. In some cases steam is used to heat the chips in order to get more oil off them. In order to do this work economically proper arrangements should be made so that handling is cut to the minimum and that the oil flows by gravity when possible. After the oil has been removed by the centrifugals it should be filtered or clarified. When this is done the oil should be equal to new oil and may be delivered to the oil storage room or delivered to the machines. For this work a portable tank on wheels with a pump attached is economical, convenient and a great time saver. The amount of oil wasted in a plant in a year is surprising and every effort should be made to conserve it. Oily waste may be collected in special trucks and cleaned by steam and centrifugal separators and the oil reclaimed and the waste dried and used again.

In its broad sense, the work of the sanitation department safeguards the health of the men by keeping the whole plant in a sanitary condition. It also takes care of the cleaning of windows and artificial lighting units so that the men will have the best light possible. By keeping the floors and walls clean and attractive it makes the men more contented, and by keeping the buildings in good condition the depreciation is not so rapid. In order to be sure that all the work of this department is done well, some system of inspection is necessary. By having a monthly prize with frequent inspections as mentioned earlier in this article much can be accomplished. The assistance of each foreman is necessary to get reports of dirty conditions anywhere in the plant, or of broken windows, toilets that do not flush, and other points that need constant maintenance.



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TRADE **YALE** MARK





The Yale Electric Hoist Connected to the Lighting Circuit

This Yale half-ton Electric Chain Hoist in the mixing room of a large pharmaceutical plant is plugged-in on the *single phase* lighting circuit.

With the Yale Steel-Plate Roller-Bearing Trolley and I-Beam track system it furnishes a highly economical, convenient and efficient method of handling the heavy pots of tooth paste from mixing machines to the packing hoppers.

The Yale Electric Hoist is the only chain hoist on the market adapted to single-phase current. These hoists are made in capacities of from ½-ton, quick speed, to 1-ton and 2-ton standard speed for use with either 110 or 220 volt, 60 cycle, lighting current. And the Yale line includes a hoist for every standard circuit, A.C. or D.C.

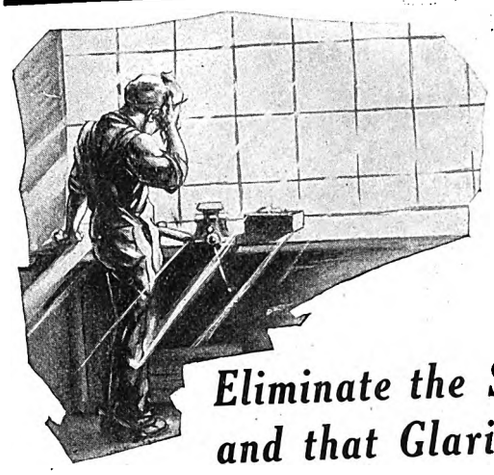
Upper and lower limit stops prevent overtravel of the load hook in either direction and the 50 per cent overload test, with the line of steel from hook to hook, assures safety under all working conditions.

The Yale & Towne Manufacturing Co.
Stamford, Conn., U. S. A.
Yale Made is Yale Marked

YALE Hoisting and Conveying Systems

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Eliminate the Shadows and that Glaring Heat

Did you ever stop to think what the production toll of the Summer sun costs you each year in decreased efficiency because of eye-strain, fatigue, deep shadows, and excessive heat? BLU-EE on the windows will diffuse the sun's rays to fill the plant all day long with a cool, pure-white, shadowless illumination. It is easily applied, costs but a fraction of what shades or awnings would, and can be readily removed with warm water.

OFFER

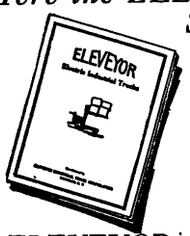
We will send you two packages of BLU-EE—enough to cover 2,000 Sq. Ft. Use one of them as a trial. If you're not satisfied with the result, return the other package at our expense. If you are satisfied, send us your check for $5.00 (discounts for quantity orders). You can't lose anything on it; the trial costs you nothing.

PARK CHEMICAL COMPANY
3822 Edwards Road
Cincinnati, Ohio

ELEVEYOR



Here the ELEVEYOR
Saves 50% of Handling Costs



These are the exact figures at this plant (name on request.)

In the handling of 175 lb. bundles of merchandise the ELEVEYOR has reduced the cost to 4.2 cents per bundle—this includes all fixed charges, such as depreciation, repairs, cost of charging and charging outfit and insurance. The hand labor method was 8.6 cents per bundle.

We have many more such examples of economies effected by the ELEVEYOR. Let us tell you about them. *Write for Catalog*

ELEVEYOR INDUSTRIAL TRUCK CORP.
56 Huntington St., District Offices Brooklyn, N. Y.

Carrol H. Thomas.....549 W. Washington Blvd., Chicago
Menner & Kimball.....Syndicate Trust Bldg., St. Louis
Eastern Sales Co.....18 Tremont St., Boston
W. L. Duncan.....347 Arcade Bldg., Norfolk, Va.
H. Lee Reynolds.....Henry W. Oliver Bldg., Pittsburgh, Pa.
Export Repr.....International General Electric Co., Schenectady, N. Y.

Modern Ethics in European Factories

(*Continued from page* 31)

with accepted modern American industrial psychology.

Bournville village is an estate of 942 acres adjoining Birmingham, England. The freehold of the land is owned by the trust endowed by George Cadbury in 1901; the whole of the revenue is to be used for the erection of cottages, the purchase of additional land, and for the general improvement of housing and town-planning conditions. The area of the estate includes the property of Cadbury Bros., Ltd., but residence on the estate is not limited to employees of the firm. There are 1,077 houses and 5,500 inhabitants on the estate. In addition to the gardens there are 1,113 allotments.

The factory buildings housing the Cadbury chocolate manufacture and its subsidiary trades employ 10,000 people. The buildings were removed from Birmingham in 1879, and in their new location are designed not only to meet every requirement in the way of lighting, heating and ventilation but to be made as attractive as possible to the worker. In the words of Mr. Cadbury's associates: "The erection of the factory in a country district outside the large town, the preservation, as far as possible, of any natural features which make for beauty both inside the factory bounds and in its surroundings, such comparatively minor points as the hiding of bare brick wall by climbing plants, the use of decorative flowers and plants in dining and work rooms, the encouragement given to organized singing at work, all these and other provisions, in their elevating and refining effect on mind and spirit, inevitably react favorably on physical health."

Education and health have been among the strongest factors to build up the Cadburys' business. Two figures may be quoted as evidence of the latter: $\frac{7.7}{15.9}$ and $\frac{51}{97}$, which mean the ratio per thousand of the average death rate and of infant mortality in Bournville and in all England.

The blocks of buildings are separated from each other by streets, which not only enables the rooms to obtain a maximum of light and air, but also minimizes the danger in case of fire. Ventilation is carried out as far as possible by natural methods. The various rooms in the factory are periodically sprayed with an odorless disinfectant. There are dressing roms with facilities for drying wet clothes, and overshoes are supplied at low rates during wet or snowy weather.

The hours worked in the factory are normally 44 per week, made up as follows: Monday to Friday, 7.45 a. m. to 12.30 p. m.; 1.30 p. m. to 5.00 p. m.; Saturday, 7.45 a. m. to 11.45 a. m. This gives a total of 45¼ hours, but on every fourth Friday work ceases at 4 p. m. and the following Saturday is a full holiday, thus adjusting the difference. When weights have to be systematically lifted or carried it was found that anything in excess of the following is liable to cause injury:

Boys under 15.....17 to 18 lbs.
Youths under 17.....24 to 30 lbs.
Men under twenty.....30 to 38 lbs.

and for weights in excess of the above specially selected

(*Continued on page* 89)

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Handling Costs Cut In Half

$125 Saved Every Week!

THAT'S the record of one Baker High-Lift Truck at the Brooklyn warehouse of the American Tobacco Co. Here are the actual figures on its performance.

Unloads hogsheads from freight cars,
releasing 2 men, at $50.00 weekly, for other work.

Stacks 1200 lb. hogsheads in warehouse,
releasing 3 men, at $75.00 weekly, for other work.

Loads commercial trucks from warehouse,
cutting handling costs from 25c. to 12½c.

You can raise 4000 lbs. through 6 ft. with the Baker Hi-Lift elevating platform truck, carry it away and then buck the load into position.

This warehousing model for use in cramped quarters is only one type of Baker industrial tractors and trucks. Our catalog describes them all.

Baker Industrial Division

THE BAKER R & L COMPANY CLEVELAND, OHIO.

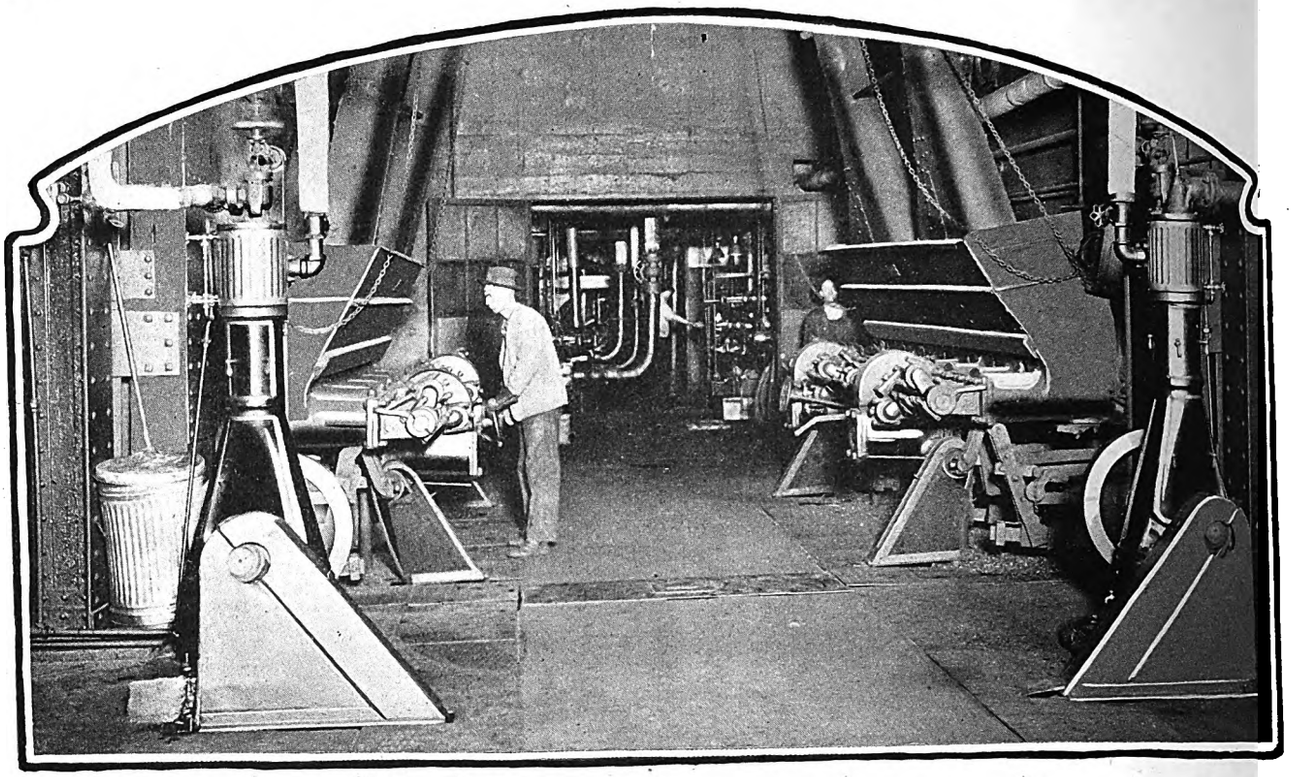
ELECTRIC TRACTORS AND TRUCKS

TRADE-MARK REG. U.S. PAT. OFF.

Baker

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Low Cost Dependable Power

That Troy Engines meet every requirement of the smaller as well as the larger plant is nowhere better shown than at the Lynch Coal Mine of the United States Steel Corporation, Lynch, Kentucky.

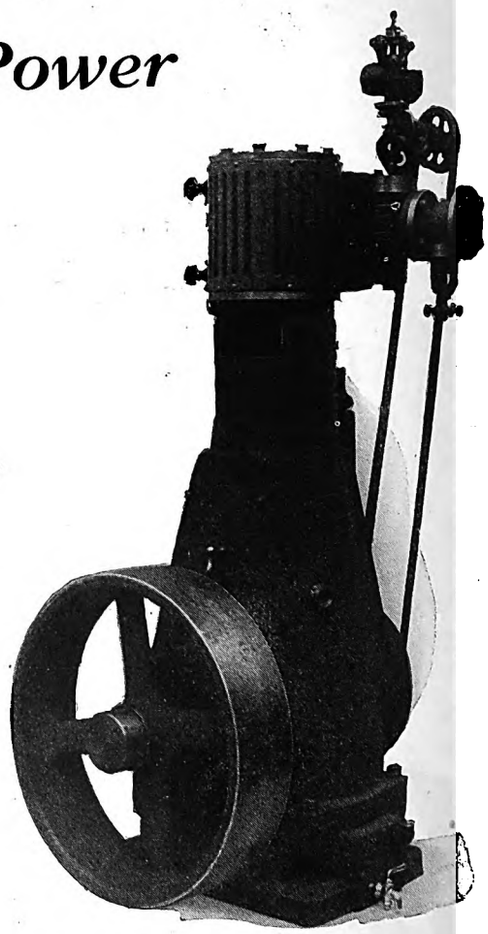
Here the two Troy Engines drive the stokers and more than pay for themselves in carrying the whole load at night, Sundays and off-peak periods.

Thus Troy Engines meet every requirement for highest efficiency in the smallest space.

The many Troy features make this possible—the rugged construction, compact and symmetrical—the self-oiling feature and the balanced valve which remains steam tight and sealed for years and avoids the expense of renewing bushings and valves. This balanced valve makes Troy Engines exceedingly safe under all working conditions because condensation is automatically cleared from the cylinder.

Troy units are designed for all industrial power requirements in capacities up to 200 B H P.

Write for the Troy Catalog.



TROY ENGINE & MACHINE CO.
TROY, PA.

TROY ENGINES

Dependable Power with Absolute Safety

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(*Continued from page* 86)

men are appointed. For inefficient and slow workers there are special provisions in order to get the best out of them.

The medical service afforded the workers is extensive. There were 26 severe and 1,500 slight accidents, only one fatal during the past 14 years. Instructions are given that every accident, however slight, shall be immediately reported and prompt attention given. This stringency is reflected in these figures, the apparently great increase of minor accidents being an index of the number reported. If this precaution is not taken, the employee forfeits the company's supplementary gift for accidents. The majority of workrooms and offices are fitted with an ambulance box in definite charge of one or two members of the Works Ambulance (who possess St. John's Ambulance certificates) employed in that particular room. When any infectious diseases occur at the home of an employee he must not return to work, in the case of scarlet fever, diphtheria and membranous croup, for 8 days; mumps 21 days; other infectious diseases 14 days,—and until certified by a medical man to be free from infection, such certificate to be countersigned by the works doctor. These arrangements are an adequate contribution to the safety-first campaign; and their cost represents only four shillings per cent. of wages.

Especially remarkable is the institution of the works dentists. All applicants for work are examined by a works dentist as part of the preliminary medical examination. It is a condition of employment that all who enter the works under 18 years of age shall have what dental treatment is considered necessary. Toothbrushes and powder are given free to all entrants under 18 and sold at cost to the others.

There are many other institutions worth notice in that factory—the works councils, the educational facilities, the employees' recreations, the magnificent swimming baths, dining rooms, clubs, the benevolent funds, the Bournville Works magazine. These provisions added to the special features mentioned above make not only for a high standard of health but create a spirit of loyalty which I noticed through the village and works, a spirit built upon love.

The ethics of George Cadbury are given eloquent testimonial in the "memory lamps" lighted by his friends soon after his death. "To meet him," says Mr. Davenport, "was to step into a ray of sunshine, and to feel a glow of human kindliness beyond expression." Dr. Hodgkin says: "How many a man is a better man because George Cadbury dared to trust him! I think of George Cadbury as a man who loved, who had something that touched the common human chord. He cared about men and women. He felt with them." That is inspiring language when we are speaking of industrial ethics. George Cadbury saw things and developed action under a high angle of vision. His earthly journey ended like his daily life, "with a walk in the evening to the top of a hill."

The Hill—such is, precisely, the name of the London residence of Lord Leverhulme. And for the fifty years that William Hesketh Lever has been in business the rising of his fortune has been the just reward of the uninterrupted elevation of the man. To write about Port Sunlight, his soap works, his army of employees, his delightful garden village, would be only to dwell upon



Specify "STURDI" for Your Plant

—Just a "Lift-Truck" Won't Do!

Where aisles are narrow and loads heavy, STURDI-TRUCKS, with their superior "any angle" lift can always be operated in less space.

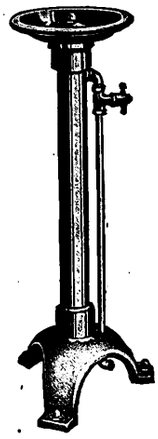
One man lifts—and pulls—5,000 lb. loads with ease. The exclusive SINGLE FRAME gives full 3 or 5 inch elevation. Powerful step-by-step lift. Write for catalog and price list.



STURDI-TRUCK MFG. CO., Inc.
Wilmington, Delaware

Cap. to 5000 lbs.
3 or 5 in. Lift

MURDOCK
WATER SERVICE



"Sandow" Fountain Self-Closing

Heavy Duty
DRINKING FOUNTAINS
for
SHOPS

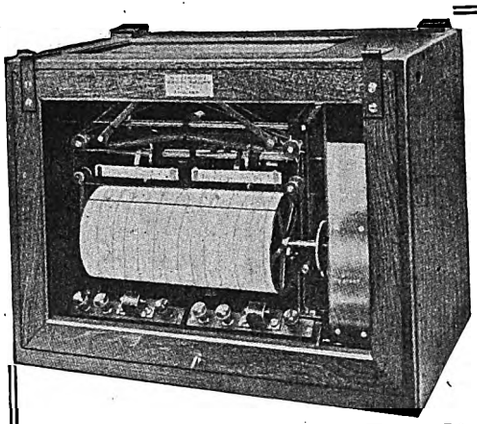
Real water devices made especially for hard service.
Practically everlasting in life and performance.

BUBBLER HEADS
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"SAFETY" FIRE HYDRANTS THAT WILL NOT FREEZE
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THE MURDOCK MFG. & SUPPLY CO.
CINCINNATI, OHIO
Makers of Water Devices since 1853

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Cambridge Electrical CO^2 Recorders Indicators

Four Independent Readings from Four Boilers on ONE Chart

are afforded by the Cambridge instrument shown above. This feature makes it the logical choice for the busy boiler room. By showing four CO_2 percentages on one chart time is saved and the possibility of errors in reading is greatly reduced.

Cambridge Electrical CO_2 Recorders and Indicators are extremely accurate and rapid in action and practically fool proof. They are entirely electrical —no chemicals to renew—no glass or rubber parts to break or wear out. These rugged instruments may be installed any distance from the flue. Maintenance cost is very low.

Other Cambridge Instruments—Electric Distance Thermometers, Thermo-electric Pyrometers, Optical Pyrometers, Pressure Recorders, Draft Gauges. Write for List No. 157F, containing interesting data.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of INDUSTRY ILLUSTRATED, published monthly at New York, N. Y., for April 1, 1924.

STATE OF NEW YORK, } ss.
COUNTY OF NEW YORK, }

Before me, a Notary Public in and for the State and County aforesaid, personally appeared John H. Van Deventer, who, having been duly sworn according to law, deposes and says that he is the Editor of the INDUSTRY ILLUSTRATED, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, and business managers are:

Publisher, Engineering Magazine Co., 120 West 32d St., New York, N. Y.

Editor, John H. Van Deventer, 120 West 32d St., New York, N. Y.

Managing Editor, None.

Business Manager, Harvey Conover, Jr., 120 West 32d St., New York, N. Y.

2. That the owners are:

Engineering Magazine Co., 120 West 32d St., New York, N. Y.
John R. Dunlap, 120 West 32d St., New York, N. Y.
J. R. Dunlap, Jr., 120 West 32d St., New York, N. Y.
John H. Van Deventer, 120 West 32d St., New York, N. Y.
Harvey Conover, Jr., 120 West 32d St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN H. VAN DEVENTER, Pres.

Sworn to and subscribed before me this 27th day of March, 1924.

JOSEPH A. BURLANDO.

(My Commission expires March 30, 1925.)

an old story. But to realize that the creative genius of the Soap King is not yet satisfied with the many institutions which make his factories an object lesson to students of social welfare and industrial management is worth consideration.

The great discovery of his Lordship's life was that basis of partnership best adapted to modern business. All the employees of Lever Bros. and of the associated companies are now entitled under certain conditions to certificates of co-partnership making them shareholders of the concern and partakers, as such, both of the gains and of the losses. Significant of success is what Lord Leverhulme had to say at the end of 1922 about his experiment: "The last two years of strain that we have gone through in business have proved that co-partnership is a sheet anchor in such a time, and that it is adversity that draws human hearts together and not prosperity. We all know it. You find your friends when you are in adversity; you do not know your friends when you are in prosperity. Co-partnership has come through the ordeal, and proves that it stands adversity."

The ethics of Lord Leverhulme are manifest in his last speech, where he shows the slow progress of human engineering as compared with that of science, and where he expounds his insurance scheme: "Science marches forward: we human elements have lagged behind. We have never adapted the human element in business to produce the best results. Science has made advances on Robert Fulton's first steamship, for we have the Mauretania, the Olympic, and others,—but in regard to schemes for humanity, no.

"We are living in better houses, living under better conditions, and with greater comfort, but in the line of relationships between each other we have not advanced much. Let us hope that before we solve the power of the atom we will have solved the mysteries of the power contained in every human breast."

Among the most representative English firms wherein applied industrial ethics are noteworthy, I shall briefly mention the following:

At the Crumpsall Works of the Wholesale Co-operative Society, George Brill, first director, gave forever his touch of brotherliness to his fellow working people. At the Irlam Works a tactful social secretary gives guidance to the employees.

Rowntree at York and Reckitts Blue at Hull are famous for their garden villages and for their kindly way of dealing with their employees.

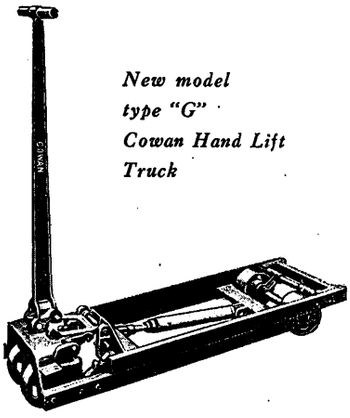
The Spirella Works at Letchworth Garden City (England) erected by Mr. Kincaid, president of the Niagara Chamber of Commerce, are a monument both to the magnificence of American industrial architecture and to the gentle art of making girls, women and boys happy in their labor.

On the side of the workingmen, the Educational Alliance founded by Mandsbridge, the Adults' Schools, the Settlements, the Labor College (Ruskin College) at Oxford, and similar agencies are responsible for a moral and intellectual uplifting.

But whatever the developments of modern English industrial ethics, the whole edifice is more or less resting on cornerstones laid half a century ago by such men as Ruskin, William Morris, the seventh Earl of Shaftesbury. The industrial ethics of the Earl were quite revolutionary when he uttered them: "There is nothing so

(*Continued on page* 92)

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New model type "G" Cowan Hand Lift Truck

Originator of lift truck system brings out new model

THE new model type "G" Cowan Hand Lift Truck is built with either a narrow or broad frame and is furnished with either a single or double front wheel construction. A highly improved release check has been adopted which insures easy lowering of loads without shock or damage to loads or floors. These and many other excellent features make it a truck of superior merit.

Over 12,000 users must mean quality

THE fact that this business has been built up in a very few years from nothing, to one having 12,000 users, is excellent proof of the quality of Cowan Trucks and Skids, and of the value of the Cowan system of reducing handling costs. It would take more space than is available even to list the different *industries* in which it is used. Nevertheless, for your information, a few typical industries are listed here.

Paper	Railroad
Woodworking	Textile
Packing	Electrical
Laundry	Chemical
Dairy	Pottery
Machinery	Automobile
Warehousing	Tire

Confectionary

Saves $1200 a year with one Cowan Truck

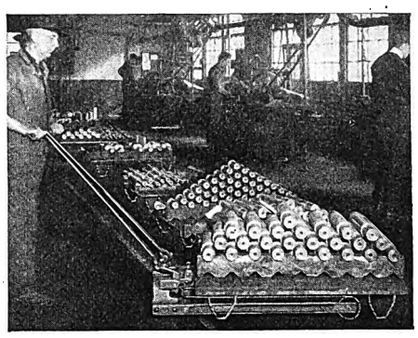
RESULT of installing Cowan System in plant of E. K. Jennings and Sons, New London, Ohio, indicates remarkable possibilities for others.

If you should go out to New London, Ohio, and step into the plant of E. K. Jennings and Sons, manufacturers of concrete blocks, you would see, in efficient operation, a single Cowan Hand Lift Truck, serving 15 skids. And they would tell you, if you inquired, that this equipment averaged to handle 12 tons of material per day, at the saving of one man, or ten hours, or $4.00. Figured roughly on a 300 day year basis, this represents a yearly saving of $1200, which is small compared to what the Cowan Plan and Survey often shows a manufacturer he can save.

Saves 40 to 60% of handling costs

COWAN equipment is not just merchandise, but a system of reducing handling costs through the elimination of unproductive labor. 40 to 60% of handling costs saved is not unusual. In actual figures this often mounts into the thousands of dollars, depending upon the size of the company, and the amount of material to be handled. It is just exactly so much more net profit. A manufacturer recently wrote us, "I have often said that this truck was worth its weight in gold to us in the handling of the new machinery in this mill and also the cotton from our receiving point into the storage warehouse."

The basis of the Cowan System is the "through-ticket skid," which may be compared to a movable section of floor space. The skid and the load which it supports may be picked up by the Cowan truck, carried to a new location and set down, without loading or unloading. As you know, there is an enormous amount of "carrying from here to there" in any manufacturing plant. The Cowan System eliminates the wasted labor of loading and unloading every time the "here to there" process occurs. This elimination soon mounts up into thousands of dollars saved.



"Cowan Lift Truck in large Elevator Manufacturing plant."

Plan and Survey

JUST what equipment a particular plant or factory needs is a matter to be determined by a complete survey. And that is the way we work. We make first, as engineers, a survey of your present handling methods and costs. Then we draw up a plan to show you exactly how the Cowan System should be installed to effect the greatest saving for you, and we estimate, pretty accurately, what that saving will be.

We make no charge for our plan and survey. We merely use it as the basis for a mutual agreement between us as to whether you will or will not install the Cowan System.

Send today for information

THOUSANDS of manufacturers are today making worth while savings, more net profits, with the Cowan System. What we have done for others, big and small, we can do for you. For complete information, without obligation, simply send us the coupon below. Cowan Truck Company, Dept. A-1, Holyoke, Mass.



COWAN

"TRANSVEYORS"

HAND AND ELECTRIC LIFT AND CARRY TRUCKS

COWAN TRUCK COMPANY
Dept. A-1, Holyoke, Mass.

Gentlemen: Please send complete information about the Cowan System of Reducing Handling Costs to:

Name of Company.....

Name of individual.....

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We now use,.....do not use.....lift trucks (please check). If convenient, please give some information about your handling conditions and problems.

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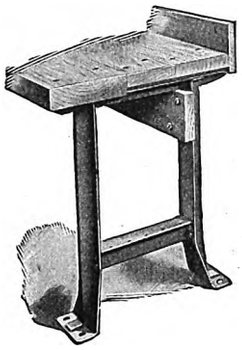
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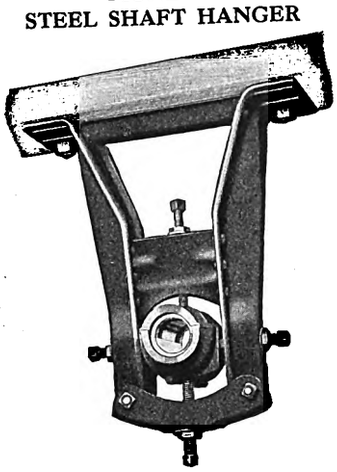
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When ordering shaft hangers insist upon the "Pioneer." It's the original steel shaft hanger.

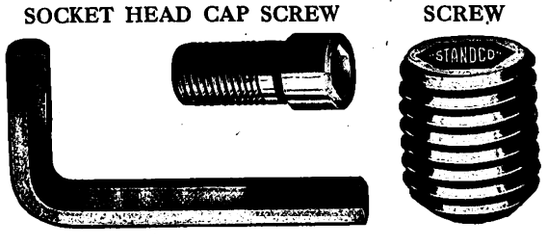
"HALLOWELL" STEEL COLLAR



Don't make your own collars—use the "Hallowell"—it's superior and costs less.

"STANDCO" SOCKET HEAD CAP SCREW

"STANDCO" HOLLOW SET SCREW



"Standco" screws, both Filister and Set, are quality products. Samples gladly furnished upon request for tests and the results along with our prices will prove interesting.

Standard Pressed Steel Co.

Jenkintown, Pa.

(*Continued from page 90*)

economical as humanity. When men are contented, they become excessively reasonable, and employers and employees find their interests are identical."

But in the England of 1924 these principles are so self-evident that an Industrial Welfare Society has been created. According to an anecdote, the origin of the Society was the outcome of the presence of Lloyd George in a munition factory when a girl worker collapsed in front of him. Having heard that the girl, although severely ill, had not been excused from work, he thought there was a link lacking in the chain of industrial efficiency. He soon consulted Mr. Rountree on the establishment of a welfare department of the Ministry of Munitions, and Mr. Hyde, a London social worker of high repute, was put in charge of the new Department. The institution, surviving the war, became a private affair, and is now part of English industrial ethics. In a recent lecture Mr. Hyde said: "The industrial welfare movement aims at eliminating the fundamental causes of unrest and misery which by many were considered necessary evils of the industrial system. The old relationship between master and man has broken down, but this movement is attempting to restore them under modern conditions."

In France, progressive manufacturers have been and are influenced by various motives; but in the main I discover in the French industrial ethics of today, consciously or not, the spirit of association instilled nearly a century ago by that visionary of genius, Fourier, in his Theorie de l'Unité Universelle. The American student in Paris will be delighted, I am sure, to listen to the masterly lesson on Fourier and the spirit of association which is delivered each week at the College de France by Professor Charles Gide. Le Play, a pioneer in the science of human engineering, and his prominent follower, the late Professor Cheysson, are also underlying influences which are actually felt.

Typically French are the Familistère Works, which manufacture heating apparatus and general hardware. They were started at Guise by Godin, spiritul son of Fourier, in 1856, and destroyed at first by the Germans in 1871, a second time during the Great War, and rebuilt in 1923 by Mr. Colin.

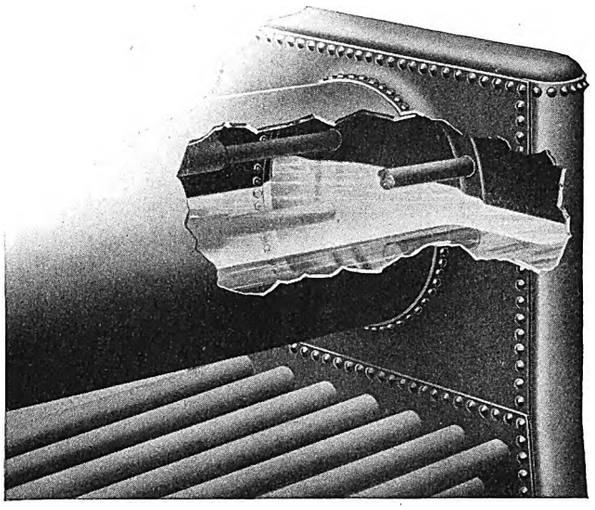
The continued success of these works is due to the close co-partnership existing, originally, between master and man, and, now, between the men who have won their title to the position of associates. In January, 1923, they had 1,700 employees, a great part of them being co-partners, and the whole force being insured against sickness and the lack of the necessities of life. The workers' co-partnership societies are federated under the leadership of that radiant gentleman, E. Briat. They have their special committee in both houses of parliament, and although their status is of minor importance, it is yet full of promise. They actually number 512, with an aggregate capital of several million francs.

Le Creusot, France's mammoth industry, offers a striking contrast to the "associations ouvrières," as it is a triumph of personal power in industry. Mining operations were started at Le Creusot as far back as 1782. Since 1836, Le Creusot has been identified with the Schneider family, whose actual representative is the

(*Continued on page 94*)

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Economy Advantages of THE EDGE MOOR BOILER



I. The Header Construction

PERHAPS the most distinctive feature of Edge Moor design is the header construction. Contrary to the usual construction, Edge Moor headers are extended, at full width, well above the tops of the drums. Thus the drums enter the header with their full area, providing a much larger throat for the liberation of steam and reducing to a minimum the frictional resistance encountered by the steam in its course to the drum.

For connecting the front and rear plates of each header, forged steel channel troughs of U-shape are used at bottom, top and sides. As shown in the above illustration, the flanges of these troughs are riveted to the inside of the plates, providing an exceptionally strong built-up construction.

The side channel troughs are forged with a slight bend at the point opposite the top of the handhole plate. This is done to secure the proper inclination of the tubes and to maintain an even water level in the drums—a method that has proved superior to the more usual custom of building straight headers and then setting the entire boiler at an angle for tube inclination.

Since not only the capacity and efficiency of a boiler, but maintenance costs as well, are largely influenced by the area provided for free circulation of water and steam, the importance of this construction will be appreciated.

Complete details of Edge Moor design and construction, in addition to much general information of value to operating men, are given in Catalog No. 63. We shall be glad to send a copy at your request.

EDGE MOOR IRON COMPANY

Established 1868

EDGE MOOR, DELAWARE

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EDGE MOOR Water Tube BOILERS

FOR INCREASED FUEL ECONOMY

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(*Continued from page 92*)

very distinguished gentleman Eugene Schneider, president of the Iron and Steel Institute. The total area of the land owned by Messrs. Schneider in France is 17,000 acres, 3,000 of which are required for shops and offices. The length of railroad tracks within the grounds is 500 miles; on these tracks run 100 locomotives and 6,500 cars. The central works are divided between Le Creusot proper, The Breuil, and the Henri Paul Works, extending for a length of 9 miles and employing thousands of people. The Breuil works produce 300,000 tons of choice steel per year; there are manufactured 350 locomotives. Everything that can be made out of steel and iron is produced by Messrs. Schneider and their associated companies. Such is a part of the organization which is under the guidance of Mr. Eugene Schneider, whose industrial ideals therefore affect thousands of employees.

The social ethics of Schneider, Ltd., seem to have evolved from mere paternalism to a mixture of paternalism and personal power, coupled today with scientific management. Let us look into its special features. The Creusot baby is cared for from pre-birth to old age. Women employees bearing a child must stop work two months before normal confinement. The works have a lying-in ward with all modern conveniences, including electric incubators. Half-orphan children have a home surrounded by a twelve acre park and are brought up there until they are fifteen. At school age they are sent to school; and the glory of Le Creusot is the schools. The elementary plus the preparatory schools will fit a boy to start work as a cadet in the factory. To the more ambitious are successively open: the special group, the High School, and the College, or Arts and Trades School. Loans of honor, to be reimbursed in after years, enable the most efficient to reach the government engineering schools of Paris. All along professional training is carefully taught. Thus a selection of material furnishes the Schneider works with young men fit for each kind of position from lower to higher. For the girls special tuition is given in household economy.

Health and safety receive special care. A safety first inspector is entrusted with precautions to be taken against labor accidents and risks of fire. The rules include general measures applicable to all departments, and chapters of special rules for each class of machines. Foremen receive together with the general prescriptions the chapters applying especially to their department, which information they must periodically read aloud and comment upon before their men.

A copy of rules is given to a man upon entering the works, and he must give a receipt for it. This constitutes the contract. No time-limit being specified, the men are as free as Messrs. Schneider to sever relations when they choose. But, wages and conditions of employment being fair, there is a remarkable stability.

Workmen's delegates selected from and elected by their fellows seek both to improve their lot and to promote good will. They are used also by the management as channels of direct intercourse with the various corporations. All petitions and complaints received and forwarded by the delegates are examined with the utmost care; during the past few years two-thirds of those presented have been granted. They cover the system of work, unemployment, working hours, discipline, wages,

(*Continued on page 96*)



Mogul Reelites are regularly furnished with any desired length of two or three conductor "Super-Service" cable. One inch male-threaded hubs facilitate mounting on brackets or machine frames.

A Guardian for Your Power Cords

No longer is it necessary to drag long, tangled lengths of heavy cable around over the floor when portable power machines are moved from place to place. The Mogul Type Reelite has eliminated that.

All of the cord not needed is kept coiled in the steel container of the Reelite, protected, clean and unkinked. It is easily unreeled as the machine is moved to greater distances and automatically re-reeled as the machine is brought closer to the power outlet, thereby saving much time and trouble and freeing the cords from the wear to which they are usually subjected.

The Mogul Type Reelite can easily be attached to any portable machine, or, if desired, it can be mounted at the outlet for extending power to the smaller machines and hand tools.

There is a type and size of Reelite adapted to every power extension requirement. Let us tell you more about them.

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Reelite
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Mack Truck Parts are Shipped in Pioneer Boxes

The International Motor Company use the same degree of thoroughness in their shipping room that they do in building Mack Trucks. Their decision to ship in PIONEER (Wirebound) Boxes was the result of careful investigation.

Read the following letter from Mr. L. J. Bennett, General Service Manager. It is worth while.

"It gives us great pleasure to state that we are more than satisfied with your PIONEER wirebound boxes, and that we do not hesitate to give them our unqualified endorsement.

"They are light in weight, which is an important item, as it saves us a considerable amount on our shipping expense.

"Since using your boxes, we have had very little breakage in transit. This has resulted, not only in a reduction in our losses in this respect, but also in our being able to give our customers quicker, better service.

"It is needless to say that in view of the fact that PIONEER boxes have been giving us entire satisfaction, we expect to continue using them."

Large and small shippers in every line of industry are giving their products better protection, increasing the efficiency of their shipping department and saving money by using PIONEER Wirebound Boxes and Crates.

It will cost you nothing to find out how they are doing it—and how you can do it. A short letter to us is all that is necessary.

Write for "General Box Service"—a booklet of information on better boxing and crating methods.

GENERAL BOX COMPANY

508 North Dearborn Street, Chicago, Illinois

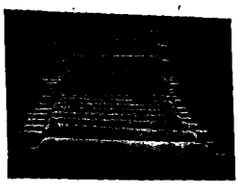
SEVENTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

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Cross-section showing Hollow construction

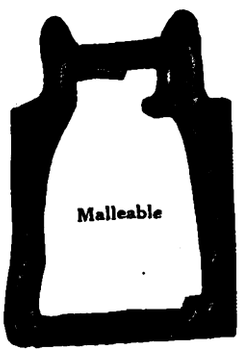
SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Made in one piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained where strain is most severe. Yet, because they are hollow, they are light in weight—saving in freight—easy to handle—power cost reduced. Built on order to meet requirements.

Wm. Wharton, Jr. & Co., Inc.
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Cylinders for high pressure gases, Seamless steel tubing, special trackwork for Steam and Electric Railroads.





TISCO MANGANESE STEEL CHAIN

Compare the condition of these two links placed in the same line of chain at the same time—one of Tisco Manganese Steel No. 103 Chain and the other of malleable chain. Manganese Chains usually last from five to fifteen times as long as malleable chains. Wherever equipment is subjected to hard wear or handles gritty materials, Tisco Manganese Steel will give greatest service.

Taylor-Wharton Iron & Steel Co.,
30 Church St., New York City

Chain and sprockets — Dipper teeth — Liners for ball mills — Mantles and concaves for crushers—Jaws for jaw crushers.

Bulletins covering the products of the several companies will be sent on request.

(*Continued from page* 94)

machinery and equipment; and herein comes the spirit of association.

Monsieur Schneider is a firm believer in helping the individual to a useful specialization, although he does not believe in submerging in over-specialization his scientists and top men of broad view. He is taking the American point of view that in most cases "humanized industries" are a natural sequence of organized business, and social welfare a part of the whole plan. He says: "Most of our industrial problems take us back to the securing of a good organization, before anything else, even before purely scientific pursuits. We must first put our house in order, that everything being in its place the chiefs and scientists may have their full liberty of mind devoted to their investigations." As a proof of the value of organization Monsieur Schneider shows that in a particular case when the work to be accomplished was let in the workrooms under the old routine and also under scientific management, the times of manufacturing were respectively 43 days and 11 days.

Midway between Guise and Le Creusot we may note the thoughts of a representative selection of French manufacturers on actual industrial ethics.

Mr. Hanra, Eastern Mines Director: "The main need of the working class is education. But the employer must go carefully in that direction; he must know thoroughly the state of mind of everyone, lend only a hand, encourage personal initiative and coöperation for the raising up of the whole community.

"I am sure that the employer must evermore concern himself with the welfare of the worker, and not only by interest but by fellow feeling. . . . Find the way to his heart and then the great problem of capital and labor will be adjusted. Life during the Great War, when we were all mixed in ranks and files, taught us to have a better knowledge of ourselves, to love better one another. Let us now call our industrial troops to order and find the true chiefs."

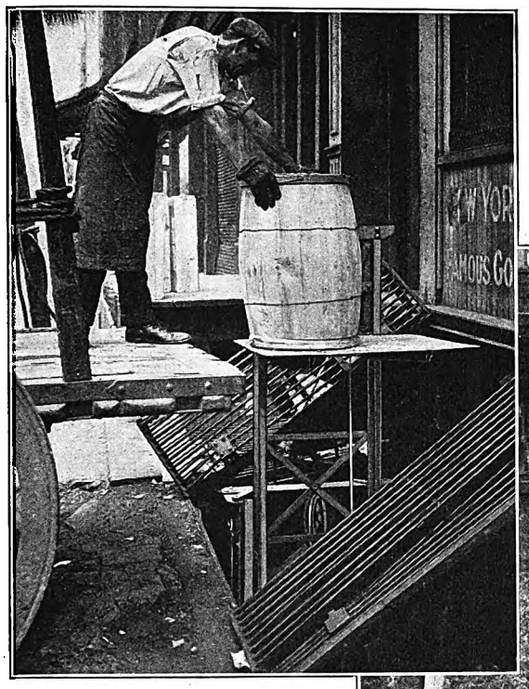
Messrs. Valon Argod Mossand, Southern Hat Manufacturers: "We believe that human capital, living asset to production, is much more valuable than the materialistic or dollar capital. According to our experience a well paid, healthy, agreeable work brings peace to the minds, strength to the bodies, security to the lives of the workers, stability to their employment. Moreover, the manufacturer is morally and materially the gainer."

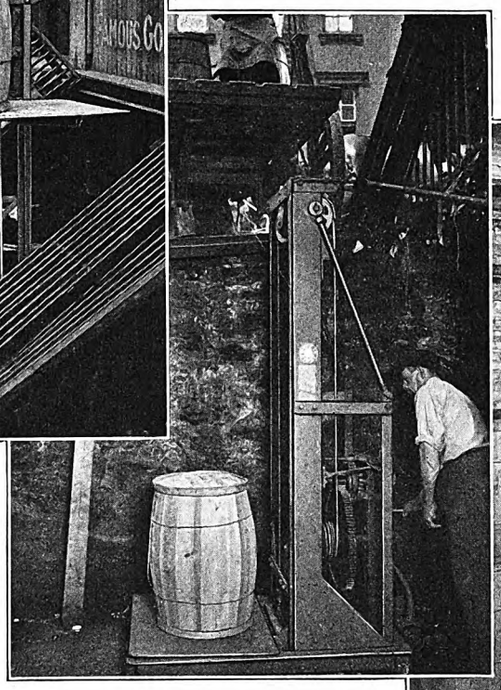
Les Etablissement Réunis, Middle France Cloth Manufacturers: "Every job is to a certain extent a social function and every trade a social ministry. Then, every lack in the professional ethics is detrimental to the commonwealth. The employer who only sees in his business a money-making machinery, and the employee who looks upon his daily task as a bread-getting drudgery, are both to be pitied. Let us put conscience and good will in our work. Life will then be brighter to us; we will efficaciously coöperate to social peace, first step towards the peace between nations."

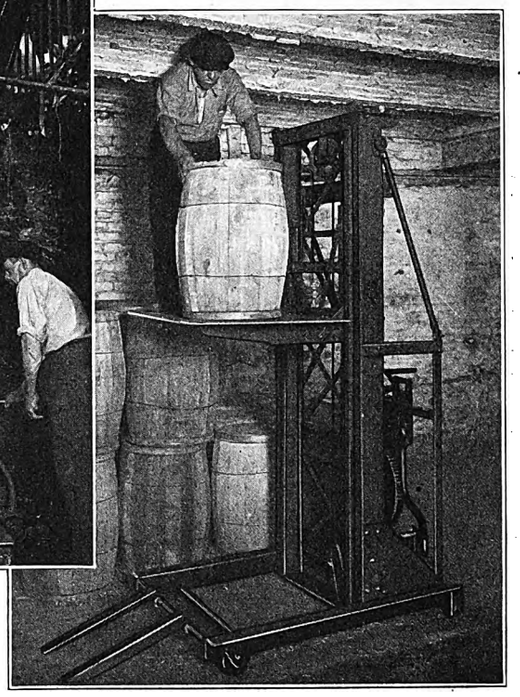
Messrs. Fraenkel and Herzog, Western Cloth Manufacturers, president of the Chamber of Commerce of Elbeuf: "Our working people are our best friends. We want to deal honestly with them." They have a model nursery for the use of the mother-employees, and have erected a garden village for their workers, in memory of their two sons killed in the war.

(*Continued on page* 98)

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High or Low

with this Economy Portable Elevator

It Telescopes

HIGH or low—up through the trap door to the wagon level or down under the low brick arches in the basement, the Economy Telescoping Machine adjusts itself automatically and does its work at either height.

Think what this means to you. It is now possible to get a portable elevator that will work in the odd places around the plant, places where steam or sprinkler pipes interfere, where overhead beams or trusses cut down the headroom or where ceiling heights vary considerably.

If you have such places where you wish to use a piler, this new Economy Telescoping Portable Elevator will do the work as no fixed height machine can. Write for working model showing how it is done.

Economy Engineering Company

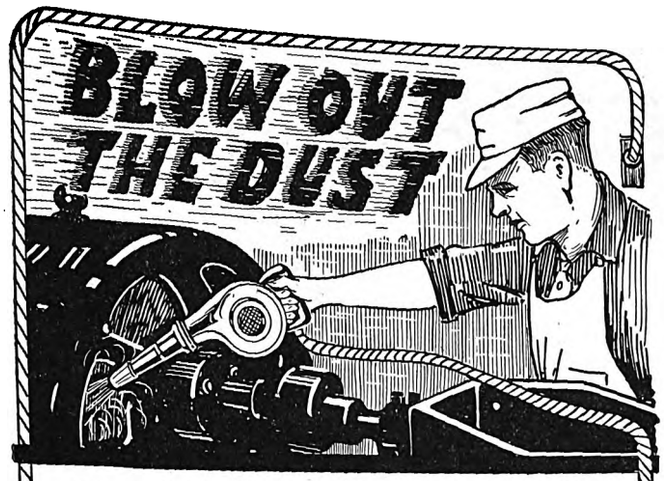
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Has hundreds of uses. Weighs 6 lbs.—attaches to any light socket. Thousands in use in practically every line of industry.

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Manufacturers of the Cadillac Electric Vacuum Cleaner

612 Fulton Street **Chicago**

Canadian Factory: 74 Duchess St., Toronto
Export Department: 149 Broadway, New York City

(*Continued from page 96*)

The Orleans Railroad Co., Paris, have just started a school on wheels on the American plan, for their employees along all their lines, and have introduced scientific management into their shops.

American associated factories established in France, such as the General Electric (The Thomson Houston group), the Goodrich Co., etc., have introduced with them most of their social features.

The eight-hour work day introduced into France since the war was an incitement to organizing the leisure of the workingman. Workingmen's and allotment gardens are among the most notable features of such organization. The last available statistics of the French Department of Labor, released February, 1923, show us that there are about 125,000 gardens of an aggregate amount of 15,000 acres, provided by French manufacturers to their employees,—four-fifths of which account to mining companies.

The industrial societies in every region of France may be called societies of applied industrial ethics. They organize lectures, consultations, conventions on all the big problems of modern industry and of human engineering. The three most active are the Societie Industrielle de L'Est (Nancy), the Societie Industrielle de Seine Inferieure (Rouen), and the Societie Industrielle du Nord (Lille). Thus, east and west, north and south, we see in France both a wide interest and an effective organization for better and more human industries.

To dwell on every country in Europe would be to enlarge without adding to our general synopsis.

Germany has its main industries concentrated in the Ruhr and Rhine districts. There you can find every great iron and chemical works with its "wohlfahreinrichbungen" (social welfare departments) under strict discipline. In the Stollwerck cocoa works, near Cologne, you will find a fine spirit, not only of discipline but of real good will.

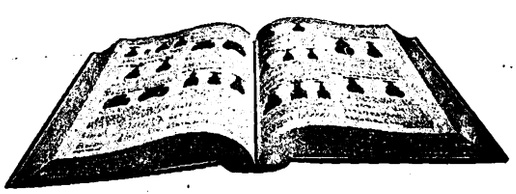
Belgium has its old industrial ethics in such companies as the Societie de la Vielle Montagne, and its new ones in such mining companies as those of the Campigny district.

Holland's most famous works organized with an extensive consideration for the workers are those of Van Marken of old times, and of the Brothers Stock, at Hengels, of modern interest.

Italy, lastly, around Milano, has splendid weaving works, where industrial ethics are applied to a vast number of workers.

As far as *Scandinavian, Tchecko-Slovakian,* and *Balkan* states are concerned, you will find a rising interest in the lot of the workmen, on the part of the manufacturer. The Department of Labor of the new states has a notable part in the government of the nation. And crowning the whole structure is the *I. L. B.* at *Geneva,* headed by a man radiant with optimism, full of knowledge, acquainted with philosophy,—Professor Albert Thomas, former employer of labor in the capacity of Secretary for the Department of Munitions.

At the end of this survey, many will indict me for having reviewed the European situation from so high an altitude that only the most prominent good features show, of having given an air photo. It is true there is much misery in old Europe's industrial communities. But it is as if in a decayed ground are found springing up beautiful trees, strong and promising.

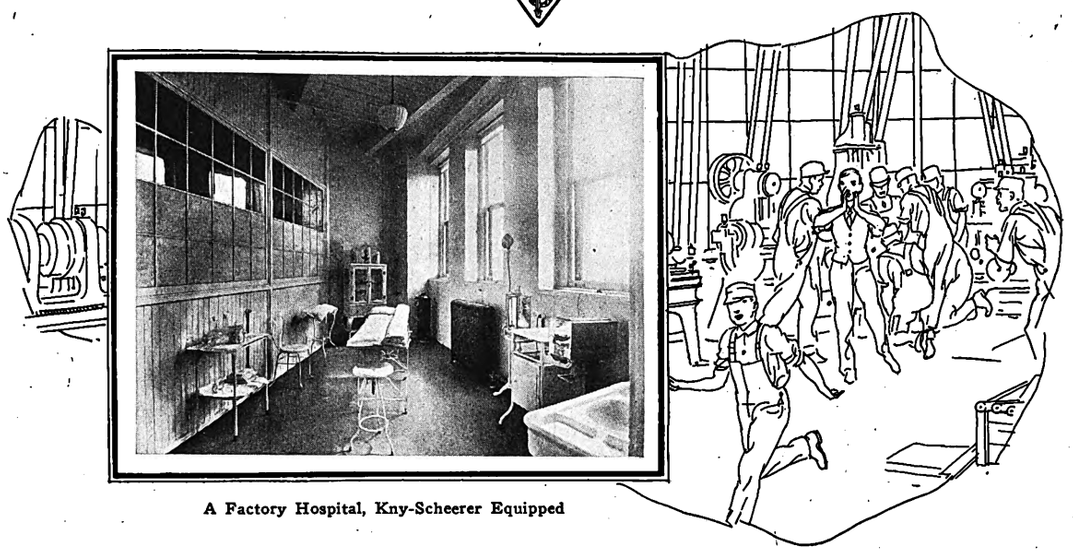


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INSURANCE, inspection and precaution have not made fire departments less valuable to the community. Quick attention is recognized as being equally important with prevention in keeping down property losses.

Well equipped plant hospitals, like fire departments, are invaluable when the unexpected happens. Safety devices, safety education, and other means of reducing accidents, are not enough protection from injuries and loss of life. Facilities for providing immediate relief when the accident occurs prevent small mishaps from becoming serious and bring the injured workman back to his bench with a minimum of time lost.

Expert assistance in planning and equipping plant hospitals is rendered by the Engineering Department of the Kny-Scheerer Corporation. Over twenty-five years' experience in the manufacture of hospital instruments and equipment is at your disposal on request.

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The workman who uses a Dayton Safety Ladder does a lot to reduce your maintenance costs. Every job he does is done in less time, done more thoroughly, and done *safely*.

He has two hands free for every job, instead of having to steady himself with one hand. He *feels* safe and he *is* safe. He can devote all his attention to the doing of a *good* job,—and he can do it in less time.

Built of strongest wood, braced throughout with steel, it is the *only safe* ladder. It is made in right sizes, from 3 to 16 ft. It meets every ladder requirement.

We would like to send you the actual facts that tell how Dayton Safety Ladders have prevented accidents, reduced overhead costs, paid for themselves over and over again in hundreds of the best-managed industrial plants.

Write to us today.

THE DAYTON SAFETY LADDER CO.,
Dayton, Ohio.

DAYTON Safety Ladder

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Barring the Gates

(*Continued from page* 19)

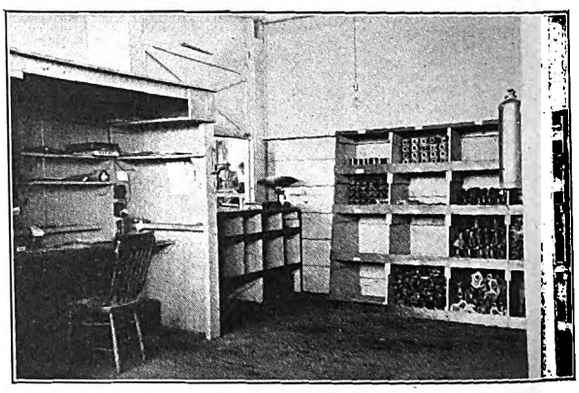
that demand is reasonably constant or, in other words, that industrial activities continue next year on the same level as last year, this means that improved machinery and improved management must together make up a labor deficit of one hundred and fifty million dollars, if management is to fulfill the obligations which this restriction in labor supply places upon it. If management does not do this, we will have wage inflation or, in other words, increases in pay without corresponding increases in production.

Assuming that the meeting of this labor deficit is divided equally between management methods and improved equipment we have seventy-five million dollars' worth of additional work to be done by new and better machinery. A machine that is capable of earning twenty-five per cent. annually upon its purchase price is looked upon as a prime investment. Here then is a demand, created by the new restriction, for three hundred million dollars' worth—per annum—of improved labor saving machinery.

So the subject of immigration restriction drives straight home to the individual American industrial executive. The National Government can pass the law putting restriction into effect—it cannot pass laws to meet and offset the result of restriction. *That* part of the task belongs to American industry and must be faced by every industrial executive—not merely as a patriotic duty but as a means of preserving his own prosperity.

THE manager of the old established factory who is having trouble with his production may find the root of the whole difficulty in his store room.

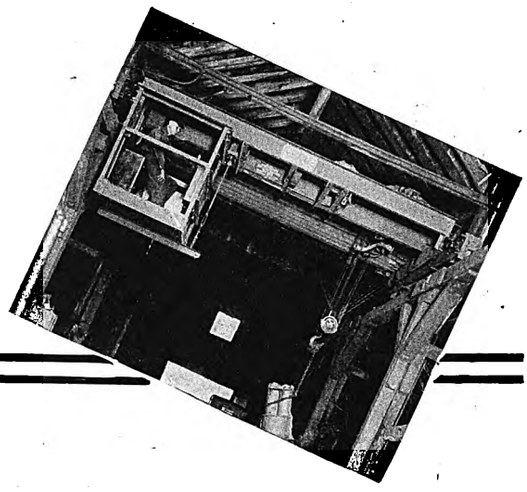
The store keeper who is given a sufficiently large and well arranged room will, if he is at all competent for such a position, keep his stock in an orderly manner and will thereby contribute greatly to the total of plant efficiency. Each bin may be marked with part numbers and names so as to facilitate location by inexperienced clerks. Maximum and minimum quantities may also be recorded and in the absence of a complete dispatching system the store keeper, by watching the low bins as orders are filled, can keep the manager advised as to parts orders which should be started through the shop or purchase orders which should be issued.



Is your storeroom functioning efficiently?

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Don't do without a standard crane for low headroom.



A recent issue of Industry Illustrated says—

"Many old foundries and other shops are doing without the services of overhead cranes because they feel that the cranes require too much headroom to fit into their buildings. This is often true of standard cranes, but in such cases special low cranes can be designed and installed."

But why install a special crane, when the NORTHERN TYPE LE, an entirely standard crane, is designed especially for and meets every condition of low headroom and high hook lift?

Standard NORTHERN TYPE LE cranes in capacities from 1 to 10 tons capacity are being used in many plants where it was thought impossible to install an overhead crane and are giving excellent results.

Our LE Division will be glad to show you how a standard crane can be used where headroom is limited. Tell us about your conditions and let us send complete information.

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A True Steam Trap—Not a Hot Water Collector

The object of a steam trap is to save steam.

Steam traps of the "bucket" or "float" type are simply receptacles for water that has dropped below the steam point and they waste instead of conserve steam.

Steam Trap Sarco *saves* heat by passing the condensate on to the hot well as *rapidly as it collects.*

There is no chance for the condensate to collect and cool. The automatic operation of a sensitive expansion element opens and closes a valve, releasing the hot condensate the minute it collects.

The Sarco can be installed quickly on any steam line without resorting to expensive construction work. And it costs only one-third as much as a "bucket" type trap.

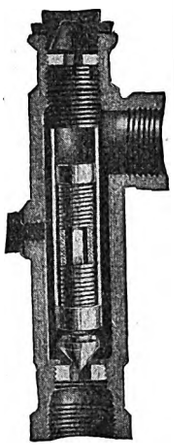
Our 30-day free trial offer gives you the option of putting the Sarco to a test at our expense.

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STEAM TRAP SARCO

There's Only One *Accurate* Method of Speed Control!

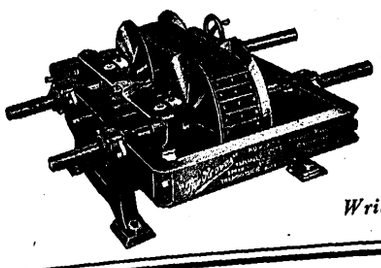
NO longer are progressive manufacturers content with "makeshift" variable speed control devices. Modern production methods demand *unfailing* accuracy in variable speed control.

There is only one truly accurate method—"The Reeves" Variable Speed Transmission. It is daily demonstrating its accuracy and dependability in industrial plants throughout the world. Write for full information.

REEVES PULLEY CO.

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"The Reeves"

VARIABLE SPEED TRANSMISSION

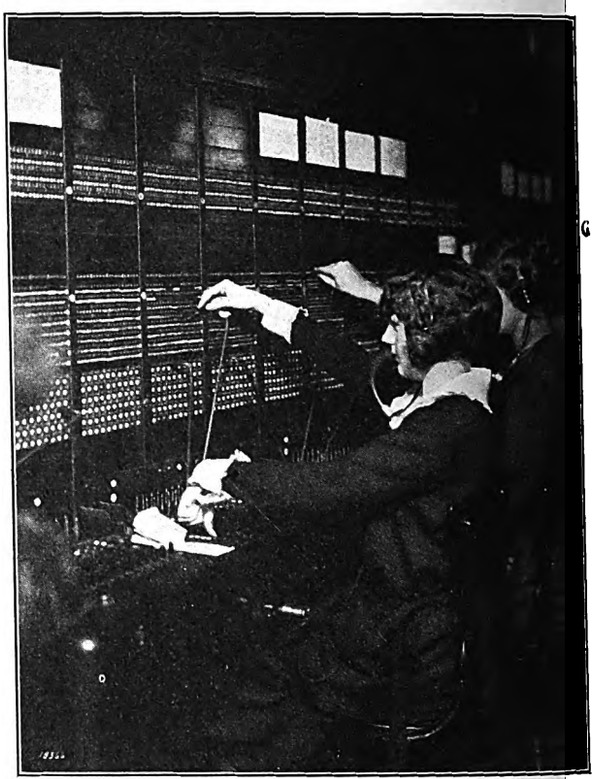
Write for Catalog T-44

Do You Get Maximum Service from Your Telephone?

By Dwight G. Baird

THE telephone has appropriately been called "The Voice of The Business." Its importance in the modern factory and office cannot be overestimated. It hardly needs emphasis, however, as every plant is now equipped with at least a single station, while the larger ones have private exchanges of considerable proportions.

At the same time, expert investigation often reveals that even the most modernly-equipped and efficiently-operated plants do not get the maximum of service from their telephone system. Telephone companies in many cities have therefore recently inaugurated special service departments for the express purpose of coöperating with



This is how the telephone company operators do it. Demonstrating the proper method of "plugging in."

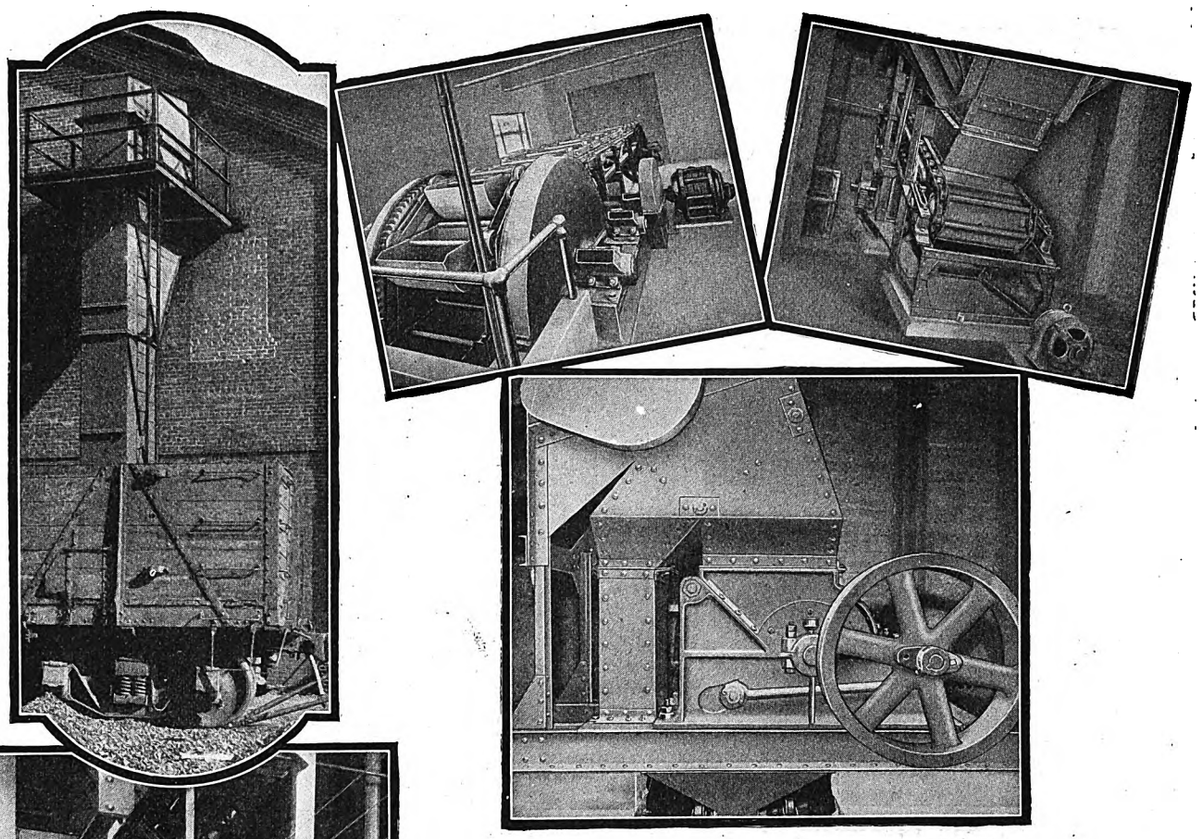
such subscribers to the end that they may enjoy the best service possible to be had. The service department, at the invitation of the subscriber, makes a survey of the private exchange and all its connections, installs new equipment where needed, and offers suggestions for removing causes that have been interfering with the service, for making additions or changes, and for training employees in the proper use of the telephone. The service is of course free, the surveys and recommendations being made for the sole purpose of coöperating with the subscriber in bettering the telephone service.

An account of conditions found to obtain in a number of plants may prove suggestive to others.

The heart of the telephone system in a large plant is

(*Continued on page* 105)

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Meeting the Needs for Suitable Equipment for Power Plants

WEBSTER equipment fulfills the requirements of every power plant operator and owner who appreciates the best methods as expressed in coal and ashes handling machinery. The big reason for the 100% service which it gives is because each installation is exactly fitted to the work required.

Webster equipment for large or small power plants is the culmination of years of experience in building and designing machinery for this work. During this time Webster engineers have thoroughly studied the correct handling of coal and ashes in power plants, and can ably assist in specifying suitable equipment to meet all needs. Check up on your coal and ashes handling equipment with a Webster engineer!

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(*Continued from page* 102)

the private exchange switchboard and it is here that the surveyor begins his investigations. Is the board large enough to handle the volume of calls? Does it have a sufficient number of trunk lines? Is the operator properly trained and does she discharge her duties in a proper manner? Does she have a rest period in the morning and another in the afternoon? Is her position properly lighted and ventilated?

In many cases it has been found that the subscriber should have a larger switchboard. An 80-line, one-position board perhaps should be enlarged and made a two-position board, so that another operator can be added. One operator may not be able to handle the volume of calls expeditiously. She is overworked, with the result that she becomes tardy in answering calls, users become impatient and begin to scold, and she, in turn, "sasses back."

In more than one plant it has been found that the operator's burden is increased by the lack of coöperation on the part of executives and others. Executives are, in fact, usually the worst offenders in this respect. They leave their offices without letting any one know where they are going and as they pass from one department to another, the operator is constantly trying to locate them, perhaps, when she should be giving her undivided attention to her board. Others take the attitude that the operator is but an employee whose time is worthy of little consideration as compared with their own, forgetting that when they put the operator to needless trouble, they are slowing up their whole telephone system. Unless an autocall is provided for locating executives when out in the plant, they should notify the operator where they will be at different intervals or else they should call her from time to time and ask whether any one has inquired for them.

Allowing other employees to gossip with operators, either at the board or over the telephone, is also often found to be an important contributing factor that results in poor service.

The practice of asking the operator to get the desired connection, then call the speaker is permissible, provided the operator has plenty of time, but it may interfere with her other work to such an extent as to interfere with the entire system, resulting in poor service for everyone.

On the other hand, it is often discovered that delays are caused by not having a sufficient number of stations, by the stations not being properly distributed, or by extension lines that might as well as not be direct lines.

In one automobile factory, for example, a number of minor executives had no instruments on their desks, but had to get up and go to a station every time they had cause to use the 'phone, while several instruments scattered throughout the offices were used very little and might very well be removed. On the one hand, this manufacturer was allowing employees to waste considerable time in strolling back and forth between their desks and the telephone stations when it would have cost only three or four cents a day to place instruments within their reach, and on the other, he was paying for a number of stations that were used very little. They had been used at one time, of course, but a rearrangement had left them idle. A little readjustment here improved the service, saved considerable time, and cost nothing.

In the same plant were a number of extension lines that were kept very busy. For some reason, the manage-



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TODAY, in thousands of busy barber shops, men ease themselves into friendly chairs and have their hair cropped in a better, quicker way by an electric clipper. Thanks to the fractional horsepower motor—which made this ingenious device possible—another visionary possibility has become a practical reality. Thanks to Dumore fractional horsepower motors and to Dumore advisory engineers, the Moore Electric Hair Clipper—pioneer of them all—has won and retained the leadership of its field.

Perhaps our Engineering Department can do for you as they did for Moore. The personnel of this department have for years been accustomed to adapting fractional horsepower motors to new applications. If you are developing a motor driven device, tool or appliance and find a perplexing power problem retarding its success—or if you are a manufacturer planning to change the power unit you are now using, you will find the advice of these experts to be extremely useful. Write them any time—they welcome problems that aren't easy.

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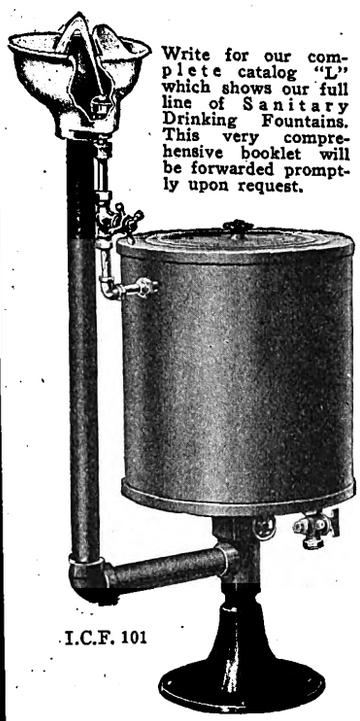


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can be supplied in a size to suit your needs. They are heavy built, dependable and durable. Coils are of tinned copper which will not rust or corrode. Equipped with porcelain enameled bowl and nickeled trimmings.

It will pay you to get all the information now and be prepared for the hot summer days.

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My experience of many years in the field of materials handling equipment is available to plant managers in helping them towards a more practical and economical selection of the proper and most applicable equipment exactly suited to every individual industrial requirement.

This service fills a long felt want and I shall be glad to send information to any industrial executive whose problem is the installation of cost cutting, economical materials handling equipment.

J. GRANT CLINE
Materials Handling Engineer
Engineering Bldg. New York City.

ment had wanted to have more than one instrument on each of several lines and the result was that when one of the parties on the line had cause to use the 'phone, he almost invariably found the other party already using it. This of course caused much annoyance and delay and saved nothing, as direct-line stations cost no more than those on extension lines.

In another plant no effort had ever been made to curtail the use of the telephones by office employees, with the result that they spent a great deal of time "chinning with their sweeties" and running up the telephone bill for the company when they should have been attending to other duties. Stations were installed in the rest room and recreation room for their convenience when off duty and orders were issued that employees should not use the telephone for private conversation at any other time.

Telephone equipment, like any other material, is subject to depreciation and it is surprising how many bell boxes one may find torn from the wall, how many transmitters broken or missing, how many cords are frayed, how many felt bases of instruments are worn away, and how much other dilapidation becomes evident when once a survey is undertaken. It costs no more to have all equipment kept in first class condition.

In one plant, executives were mystified by the fact that the whole telephone system was deranged regularly the first of every week. When the service department of the telephone company finally was asked to find and remove the trouble, it was discovered that the wires in the floor had been run in moulding instead of in the conduits provided for the purpose. As a result, when the janitors mopped or scrubbed the floor each week-end, water seeped down into the moulding, dampening the telephone wires and putting the system out of order. The conduits had been improperly installed and could not be used. In this case it became necessary to rewire the entire building, running the wires on the ceiling of the floor below and bringing them up through a concrete floor. This was done without cost to the company.

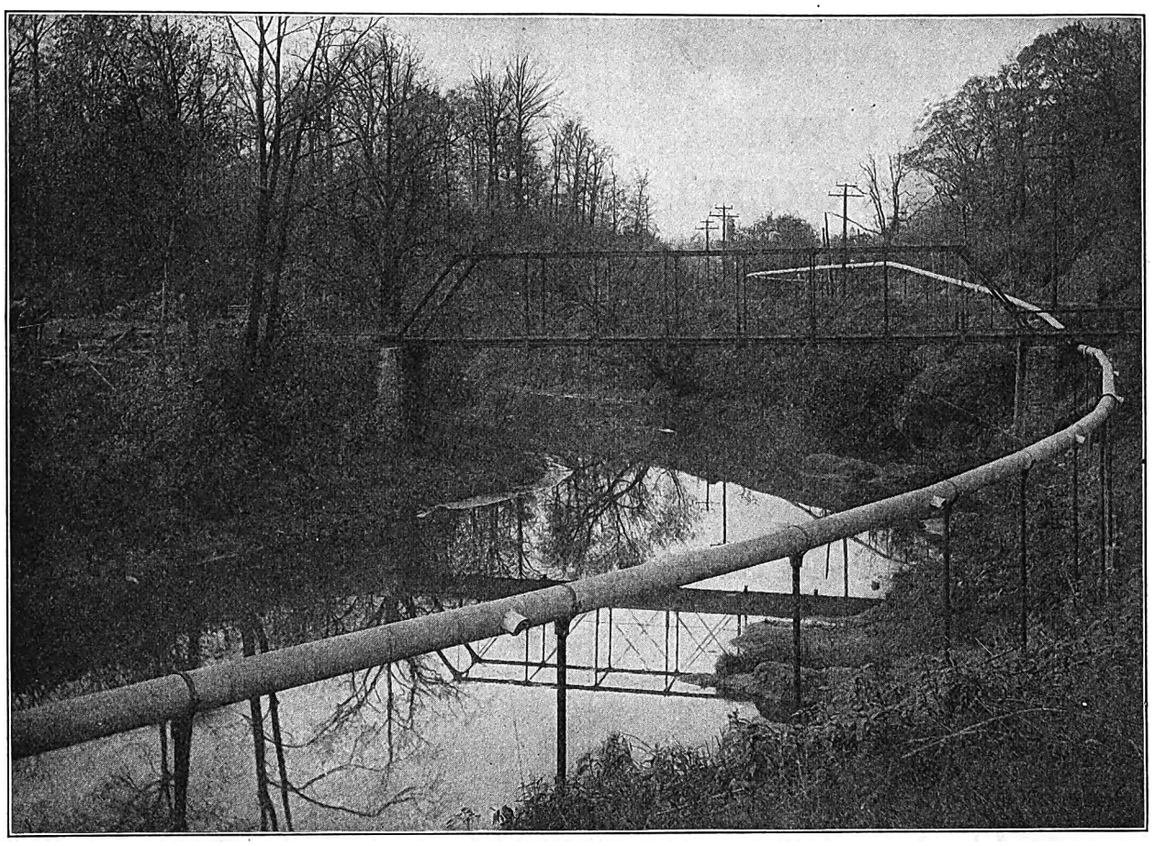
One large company that has several different plants in the same city learned, as a result of such a survey, that its operators in the different plants had developed considerable ill feeling among themselves, due to their being overworked and trying to "pass the buck" one to another. Additional tie lines (inter-plant lines that do not connect with "central") were needed, as were two or three more operators. When these were installed, the enmity ceased and the service became satisfactory.

In numerous cases it has been found that the operator's position is not properly lighted and ventilated, resulting in lowered vitality and efficiency on her part. Incidentally, there is more often than not too much heat rather than too little. The work of the telephone operator is extremely trying and the conditions should by all means be made as nearly ideal as possible. Furthermore, she should be given a rest period in the morning and another in the afternoon, if for no more than ten minutes each.

It is recommended that in plants where there are many stations, the stations be numbered and a private directory be provided. This directory may be no more than a typewritten list of names and numbers, but it will relieve the operator of a great deal of annoyance and delay in getting the right parties. This is particularly true in

(*Continued on page* 108)

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THIS PNEUMATIC CONVEYING SYSTEM SAVES $7,841.60 EVERY YEAR

Four years ago the Mt. Vernon-Woodberry Mills, Inc., of Baltimore, installed Sturtevant pneumatic conveyors.

These systems carry cotton at a total cost of only $.325 per bale, compared with $.644 when teams were used.

The net annual saving in hauling is $6,507.60. Centralization of the opening and grading work has saved $1,334, or a year in labor and floor space, which makes the total saving $7,841.60 a year. The new method also insures uniformity in grading and mixing, which results in an absolutely uniform product.

Here is a source of increased dividends well worth serious thought. Sturtevant catalog B291 tells how pneumatic conveying systems may be used in many industries.

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(*Continued from page* 106)

the case of a new operator who does not know every one in the plant by name. The larger the plant, the greater the need for using the number system.

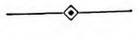
Many subscribers call the same parties by long distance telephone every few days, or even daily, and go through the formality of giving all the details with each call. The telephone companies now recommend that such subscribers code their long distance calls and file a copy of the code with their long distance operator, for the purpose of saving the time of everyone concerned, as well as of preventing error.

The subscriber simply makes out a list of those whom he calls regularly or frequently over long distance, assigning a number to each call. Thus, number one is Blank and Company, 6618 Northwest street, Chicago, Illinois, and Mr. Jackson, general manager, is the party to be reached there. Similar details are given for each call. When, therefore, the subscriber wishes to call one or more of these long distance numbers, he merely asks the long distance operator to get code numbers so and so and hangs up. If a number of calls are to be made in succession, the long distance operator will watch to see when the subscriber is ready for the second, and so on, and will call him as fast as she makes the connections.

Thus the private exchange operator calls long distance and says: "This is So-and-so Company. This morning we wish to call code numbers four, seven, sixteen, and twenty-one." The long distance operator takes down the So-and-so Company's code as previously filed with her and there she has all the details of the several calls already written out.

At the request of subscribers, the telephone companies usually are prepared to give demonstration of how the telephone system operates and to offer suggestions to employees as to the proper way to use the 'phone. It is sometimes suggested to an executive that he go out, disguise his voice, and call up his plant, and he frequently gets an unpleasant surprise by doing so. Courtesy, a pleasant tone, lips the proper distance from the transmitter, saying who is speaking or giving the telephone number instead of merely yelling "Hello!" and similar details are little things that count for much in the proper conduct of the telephone business of the subscriber.

Finally it might be suggested that the telephone companies usually are prepared to furnish trained operators for private exchanges and it is therefore unnecessary for the subscriber to advertise for an operator unless he prefers to do so. The telephone company will send him a trained operator and if she does not prove satisfactory, it will send him others till he finds one that does suit him.



More than 200 of the leading mechanical, electrical, civil, and marine engineers of the United States are sailing on June 19th on the S. S. Scythia to attend the World Power Conference to be held in London, June 30th to July 12th, in connection with the British Empire Exhibition.

A wide variety of subjects will be discussed, including ship propulsion, power for agriculture, railroad electrification, electro-chemistry, steam and internal-combustion engines, illumination, nitrogen fixation, and especially, water-power development and Super-Power.

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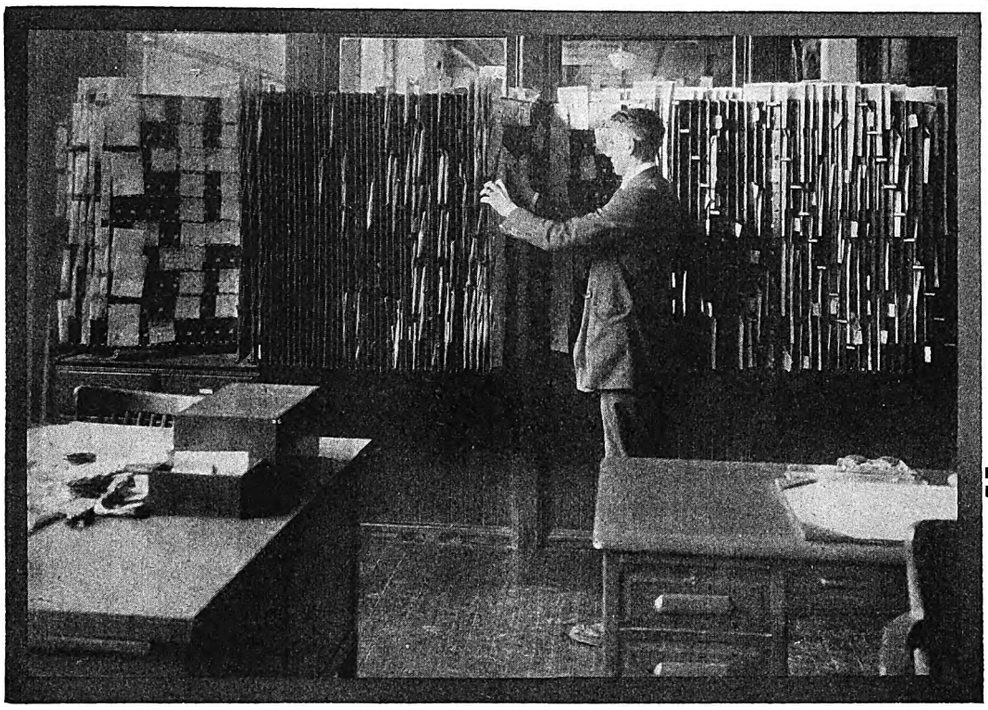
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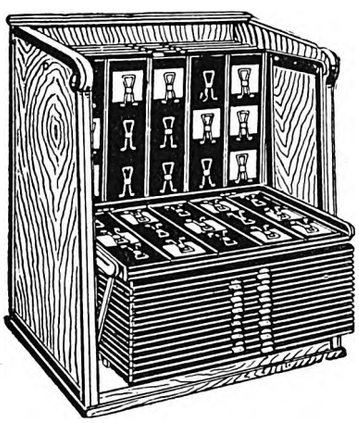
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Mr. Nelson Sage, their president, says:

"Few concerns realize the vital importance of controlling all of the elements that enter into the manufacturing of buttons from the vegetable ivory. It was to give us this control that we instituted the system we now use.



"Four years ago we established a central control production and planning department in which we installed 80 McCaskey Production Control Boards. These boards take care of approximately 5000 jobs, each of which averages 10 major operations. We also installed a number of McCaskey Department Boards and adopted the McCaskey Surety (Carbon back) Forms designed to cover each particular operation. This made it possible to tie up, with one writing, production, cost and payroll.

"In this way we get positive control of all lots of buttons in our factory which makes it possible to plan our work and move it through our plant in order and on time. Previous to the installation of the McCaskey System this was not possible.

Saves Unnecessary Labor

"The System also does away with a lot of unnecessary clerical help in our factory and gives the foremen more time for inspection. It cuts to a minimum the time required to change over machines as the foremen know definitely what job to put into operation next. The McCaskey Production Control has enabled us to get the best possible results from our factory and give service to our customers."

You may not make buttons, your production may not involve 50,000 operations, but there are great diversities of uses for McCaskey Systems. They are making savings in such work as keeping a perpetual inventory, checking tool losses, costs, and in countless other ways. You will do well to investigate a McCaskey System for your plant. We will be glad to give you more information. Write us.

THE McCASKEY REGISTER CO.

McCASKEY ONE WRITING SYSTEMS

Industrial Division
CANADIAN PLANT

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GALT, ONTARIO

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SNAPSHOTS *of Sensible* SAVINGS

Six practical methods of cutting costs are here illustrated.

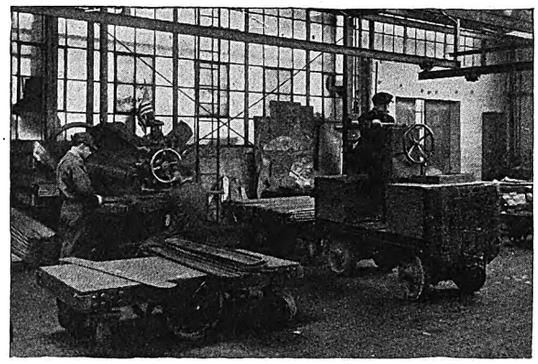
Those who are not familiar with the economies that result from the use of this equipment may find it difficult to believe that $2500 a year may be said to be a minimum for only *one* machine to save.

These illustrations are reproduced from a booklet recently issued by The Lakewood Engineering Co., a copy of which will be interesting to every reader of Industry Illustrated. Write to The Lakewood Engineering Co., Cleveland, and ask for a copy of "Snap Shots of Sensible Savings."



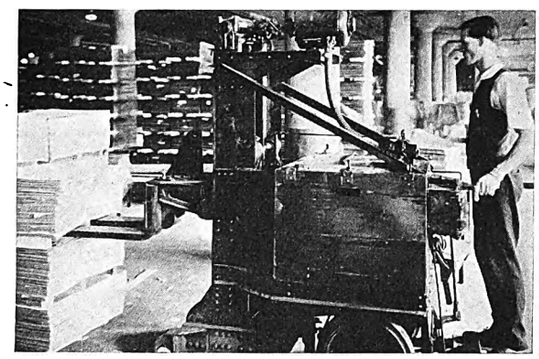
Truck Loading Simplified

The high cost of lifting and loading gets an awful wallop when the Lakewood Tier-Lift is put on the job. This Tier-Lift cuts the labor cost of shipping 30 to 50 per cent.



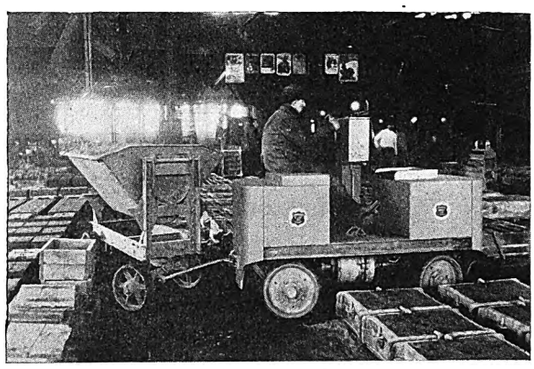
Production Is Continuous

The production value of costly machines is too great to allow them to be idle for even a few minutes. Bringing work to the producer on trailers and having the tractor do the hauling at regular intervals may increase capacity 10 per cent with no additional men.



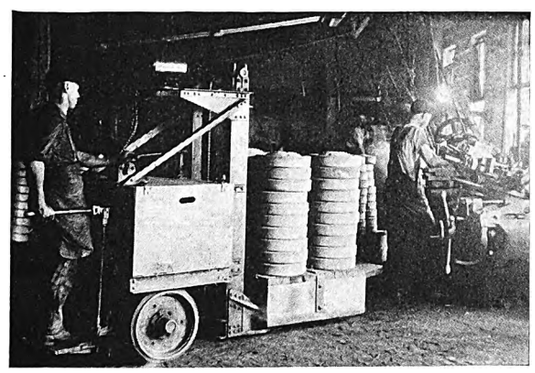
No Skids Needed

The fork attachment makes it possible to handle sheets, boxes, bales, etc., without using skids. This Tier-Lift is handling 2000 lbs. loads of sheet metal. Each load is laid on two-by-fours, providing plenty of room for the steel fork to pick up the load.



In This Foundry

The Lakewood Tractor and "V" dump trailer handle all sand, coke, castings and slag. They work the tractor nearly 24 hours a day. It is invaluable in clearing the floor of waste, carrying the castings to the cleaning department, and from there to storage or freight cars.



Save Over $5000 a Year

With the Tier-Lift forty fly wheels are carried on each skid. The aisles are clear and the men know that a skid load completed is 40 pieces. Increased production resulted from men not having to leave a producing unit to go get work. The resultant savings are over $5000 a year.

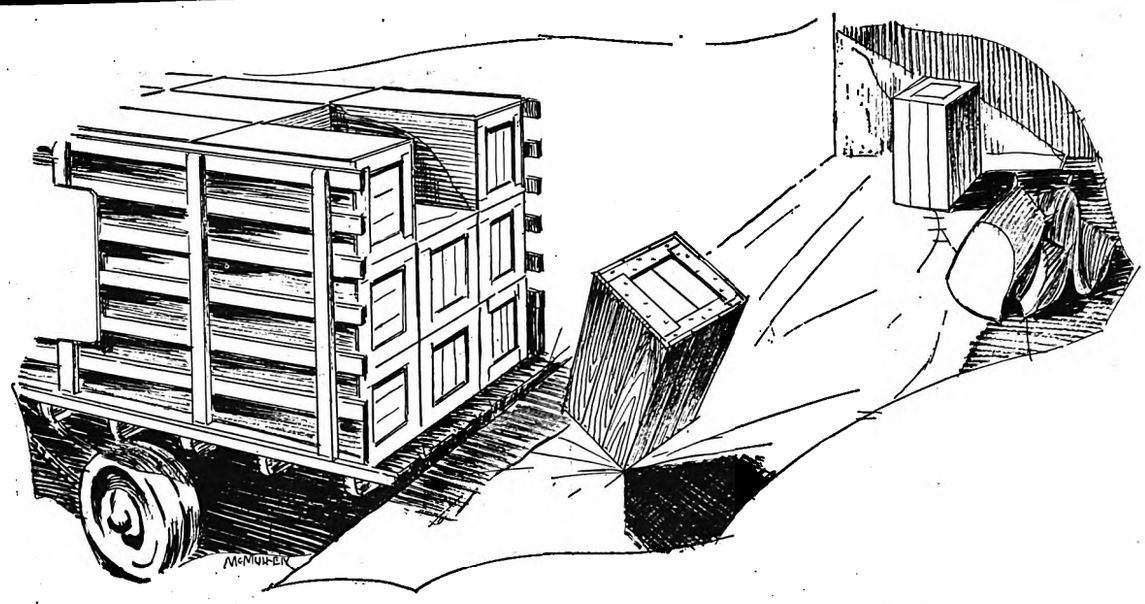


From Shop to Storage

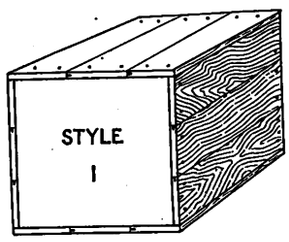
This plant works continually but stores its product to be able to take care of seasonal demand. The Lakewood Tractor-Trailer Trains reduce the cost of hauling to the warehouse. When business is brisk the product is quickly loaded.

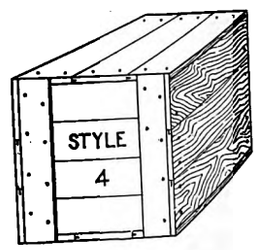
Write to the Lakewood Engineering Co., Cleveland, O., for complete booklet "Snap Shots of Sensible Savings"

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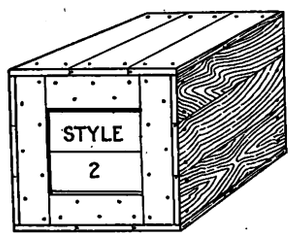


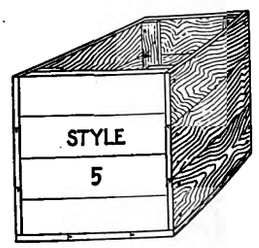
Are Your Products Protected Through to Destination?



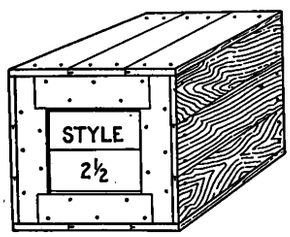


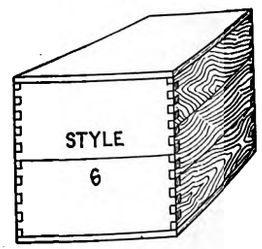
PROPER Boxing and Crating means more than merely specifying heavier lumber. An analysis of your packing and crating requirements may show that a saving in costs as high as 25% may be effected by choosing the box exactly suited to your needs.



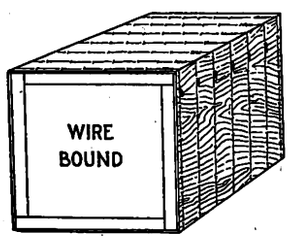


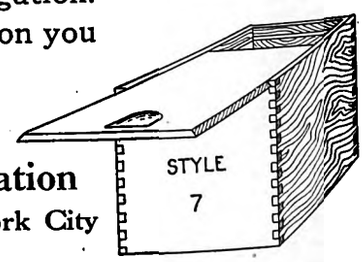
The Richards Shook Corporation have saved thousands of dollars for manufacturers in every industry, by a careful investigation of the packing requirements and then recommending the right type of box. We furnish Box Shooks, Lock Corner Boxes, Wire Bound Cases and Lumber for scores of industrial leaders, for every conceivable purpose.





The service of our Engineering Department is available to you without obligation. Have one of our representatives call on you or send for descriptive literature.



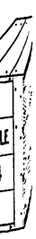


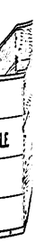
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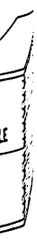
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